POPULAR SCIENCE

MONTHLY

AUGUST

5¢

See Page 42

NEW INVENTIONS

MECHANICS

THE HOME WORKSHOP

MONEY MAKING IDEAS

450 PICTURES

32 M. P. H. STANDING STILL

BUT IT PROVES THAT MODERN CARS HAVE 3 GRADES OF PERFORMANCE

You don't really buy gasoline...you buy performance and mileage. That's why you'll be doing yourself a real favor to read the basic facts about gasoline and performance. Here's what you can expect from each grade of gasoline:—

Poor performance with "low grade" gasoline

There is no anti-knock fluid (containing tetraethyl lead) in "low grade" gasoline. Power is lost because your car dealer *must* retard the spark to prevent "knock" or "ping."

Good performance with "regular" gasoline

Most regular gasoline has in it anti-knock fluid (containing tetraethyl lead). The spark can be considerably advanced for more power without "knock" or "ping."

Best performance with gasoline containing "ETHYL"

Gasoline "with ETHYL" is highest in all-round quality. It has *enough* anti-knock fluid (containing tetraethyl lead) so that the spark can be *fully* advanced for maximum power and economy without "knock" or "ping."

THIS DYNAMOMETER TEST at the Ethyl Motor Clinic clearly shows the three grades of performance. Illustrated above is the rear wheel of a popular make of car on the dynamometer rollers. Three grades of gasoline are used and the differences in power and speed indicated on sensitive instruments. This test leaves no doubt that every car has three grades of performance.

ETHYL GASOLINE CORPORATION, *manufacturer of anti-knock fluids used by oil companies to improve gasoline*

Volume 133

POPULAR SCIENCE Monthly

Number 2

RAYMOND J. BROWN
EDITOR

ARTHUR WAKELING, Home Workshop Editor
ALDEN P. ARMAGNAC, Associate Editor

GEORGE H. WALTZ, Jr., Associate Editor
SYDNEY OXBERRY, Art Editor

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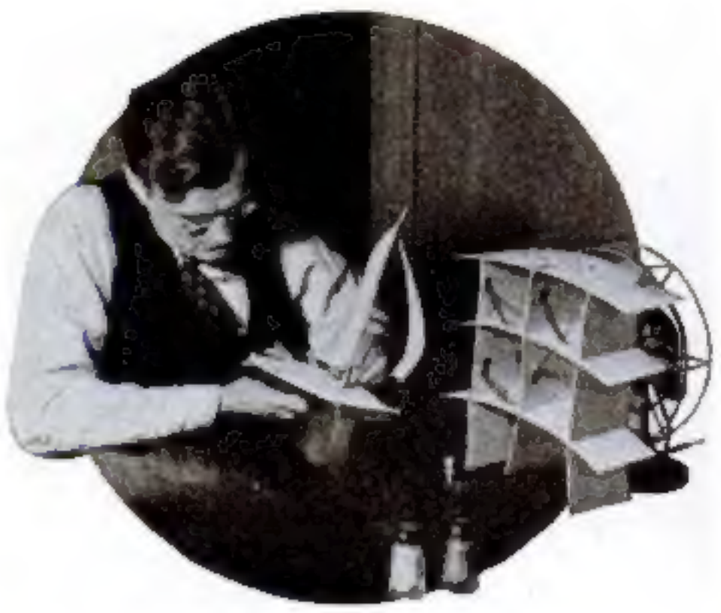

Mysteries of sailing are made clear by a model boat and an electric fan. Read the article on table-top yachting on page 36

FEATURES AND DEPARTMENTS

COVER DESIGN BY EDGAR F. WITTMACK

AUTOMOBILES

AVIATION

LAWN AND GARDEN

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MODELS

NEW DEVICES FOR THE HOME

NEW PROCESSES AND INVENTIONS

PHOTOGRAPHY

UNUSUAL FACTS AND IDEAS

WOODWORKING

IDEAS FOR THE HANDY MAN

Our Readers Say

Good Old Sodium Stearate! Now Who'd Have Thought of That?

J.P., of Kansas City, Mo., advises potassium dichromate and sulphuric acid in a hot solution (caution) for cleaning chemical glassware. This is the most common cleaning solution of the analytical laboratory, and also the most effective, but sometimes glassware may be stained by salts, such as manganous salts, which cannot be cleaned with this solution. For these, a reducing agent such as stannous chloride will work wonders. While the analytical chemists swear by the potassium dichromate-sulphuric acid solution (it removes the slight film of grease), the organic chemists swear at it. For them, nothing beats a good, hot solution of sodium stearate—to you, soap. The organic tars, resins, oils, greases, and so on, are much more easily removed by soap than by the more expensive solution.—J.A., Pocatello, Idaho.

This Bit Bit Off More Than Was Expected

Here is something that might interest your readers. I just stumbled onto it: How to bore a 1⅛-inch hole with a one-inch bit. I was installing a piece of one-inch tubing as a rod in my coat closet. In drilling the end blocks to support it, I carelessly used a seven-eighths-inch bit. So I made a plug, intending to fill up the hole and rebore it. Then I got the one-inch bit started, but it was a sixteenth inch off center in the plug. It wouldn't have mattered, except for the fact the plug slipped, turning with the bit and producing an eccentric. So the bit went around outside of the center, a sixteenth of an inch all around, making a hole one and an eighth inches in diameter.—B.F.O., Montevideo, Minn.

He Might Try Crossing It with a Stick of Candy

This devoted reader wants bigger and better asparagus! Why not? Pink grapefruit and red tangerines are popular, and so are peach-plum combinations, apricot grafts, and many others, all children of grafting. Take asparagus, and if you can return it to me with a half inch or less of stem, an all-tip flavor, at the same cost a bunch, with redoubled flavor because of increased tip area, I should consider it a fair exchange. By that I don't mean cutting the waste stem off. Grow them anew—same size, all tip! The glory of the new vegetable is all yours, but give me that asparagus!—M.G., Brooklyn, N. Y.

He Keeps the Sand out of His Sandwiches

That light-duty, one-piece tent on page 79 of your July issue takes the cake—and also keeps the sand out of it on picnics. I hopped on the idea and built the tent as soon as I took the family to our seashore cottage. Although we don't have to use it as a dressing tent, we use it for about everything else you suggested. I'm back at work after a vacation, now, but I can assure you that the rest of the family is still making good use of it. Thanks to the tent, our sunburn was less severe, our picnics are less sand-and-wind blown, our naps on the beach more restful, our family parties less public, and, at the last report, none of us had yet been socked on the head with one of those rubber beach balls that land all around you like shrapnel when the would-be Dizzy Deans of the resort start warming up. Every time I use the tent, it suggests some other way in which the thing will prove useful. At this rate, I'll soon be living in the tent all the time, and saving rent—and that's not a bad idea, either. Good luck to you.—S.A.H., Norfolk, Va.

Got His Goat, but it Rammed the Point Home

This is about an article, "Bumper for Goats Prevents Injuries," on page 15 of your March issue. After trying vainly for an hour to separate the rams and the goats, I decided that the only logical place to attach the bumper will be to the *gluteus maximus* muscles of the farmer—or to the seat of his overalls. Try, yourself, to sift the goats and rams apart. My attempt got my goat. The possibilities in my alternative measure are at least bizarre. Overalls manufacturers might put out a line with rubber bumpers in the rear for those who raise goats, rams, or both, which have that inbred tendency to raise hell with their raisers.—A.N.C., San Francisco, Calif.

Were the Fish Electrocuted, or Just Scared to Death?

Being an electrical and radio engineer, my attention was attracted by a newspaper article that credited a lightning bolt with killing a lot of fish, which were subsequently washed up on the shore of a bay. The article went on to say that lightning striking the surface of the water electrocuted the fish. I would like to know what your readers think of my theory that lightning could not do this under ordinary circumstances, and that there must have been a waterspout which sucked the fish into its column where they were electrocuted when the lightning struck the column. These spouts occur at rare intervals along our coast, sucking up everything reasonably light within their paths.—K.S.W., Sydney, Australia.

That Page of Camera Ideas "Clicked" with This Fan

Let me add my voice to the hearty chorus of cheers that undoubtedly is rising from thousands of your readers in response to the page of "New Aids for Camera Fans" in your July issue. It's such a good idea I'm surprised I didn't think of it myself and write you a "squawk" for not doing it sooner. Don't tell me this is just a flash in the pan—surely you're planning to make it a regular feature. After all, if the home owners and the housewives and the radio bugs have pages of new gadgets for their useless activities, there's no excuse for you to neglect the king of hobbies, photography. And if you don't believe it's the king of hobbies, ask any camera fan!—A.M.E., St. Joseph, Mo.

Anyone Ever See This Strange Mineral?

Recently I was doing some local prospecting in the country when I came upon a chalky-looking rock. I brought it home and found that it gave off water when heated in a closed tube. It is soft enough to scratch with your finger nail, and smells limy. On chiseling out a piece, I noticed the smell of natural gas. Then I hit the rock with a hammer and smelled it again. Every time I hit it, this gas was given off momentarily. Could any reader give me any information concerning this? Surely some of them must have encountered it somewhere.—P.J.P., London, Ontario.

It Takes a Brave Man To Stay on the Ground

That story of Andrew R. Boone's, about his experience in flying the "crash-proof" plane, made me want to get right into one of those sky flivvers and fly away. I had read a lot about so-called foolproof planes using one gadget or another that was supposed to make a veteran out of any fledgling, but always thought it was a lot of baloney. If it's like Boone says, a fellow would be a lot safer up in the air in one of those things, on a Sunday afternoon, than he would be *(Continued on page 5)*

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coaxing a jaloppy along a main highway. Give me the air, where there's more room!—A.S.K., St. Paul, Minn.

Maybe You Can Unscramble This Egg Problem

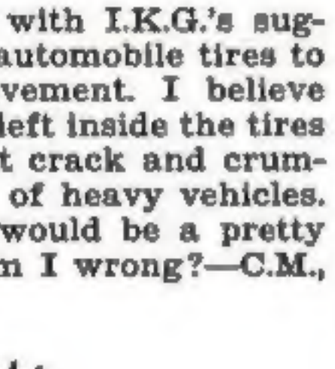
M.M.'s PROBLEM about the man with 100 theater seats to fill is comparatively simple. If J.J.O., of Fanning Island, has difficulty with it, the answer is: Seventy children at ten cents admission each, nineteen women at two dollars admission, and eleven men at five dollars admission. Now, here's a problem that should give our Pacific Ocean exile a real headache. A farmer has three sons, A, B, and C. He gives A ten eggs, B thirty eggs and C fifty eggs. He sends them to town to sell their eggs at any price the three of them agree upon. If market conditions change, the boys may alter the price, but at no time are they to sell at different prices; that is, if one changes his price, the others must change theirs accordingly. Furthermore, they are told to sell all their eggs—each his own lot—but all three of them must take in the same sum of money. How did they do it?—S.B., New York City.

He Thinks the Pavement Would Get "Tired" Out

I WISH to disagree with I.K.G.'s suggestion for using old automobile tires to reënforce cement pavement. I believe that the hollow space left inside the tires would make pavement crack and crumble under the weight of heavy vehicles. And then your road would be a pretty mess, wouldn't it? Am I wrong?—C.M., Old Orchard, Me.

Those Yankees Might Fool This Reader Yet

ONE of your readers is much opposed to more dirigibles. It seems that he prefers an airplane for an ocean crossing. I wonder if he prefers a motor boat to an ocean liner. In a long-distance run, a plane is crammed with equipment and fuel, leaving the passengers only room enough for convertible seats that they are also compelled to sleep in. If, during the trip, motor trouble or other mechanical difficulties are encountered, a landing is almost always necessary, regardless of conditions. And you know how successful most forced landings are! In a helium-filled Zeppelin, forced landings are almost out of the question, because it may stay aloft as long as its gas cells are intact. The passengers are not compelled to sit in their seats, but are left at freedom to walk about in dining, smoking, reading, and amusement halls. The Germans have built dozens of Zeppelins with great success, having had



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Our Readers Say

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only one disaster since the World War. And if they are using them successfully, why can't you Yankees do the same?—R.K., Kitchener, Ontario.

Coal Is the Perfect Food —If You Happen To Be a Stove

BEING interested in biology, I'd like to correct a few of A.F.S.'s ideas about eating coal. He says that his theory is based on the proposition that the essential value of food is heat. A high-school biology textbook would have told him that some foods are for the purpose of producing energy, of which heat happens to be one form. Other foods, just as important, serve the purpose of building up and repairing body tissue. He goes on to say that Americans are wasting a lot of coal by burning it in their stoves, instead of in their bodies. He neglects the fact that while a stove or furnace does not have to worry about getting indigestion from coal, we do. Our digestive tracts find certain solids indigestible. That is the reason for cooking certain foods. A.F.S. also neglects the fact that while coal is oxidized in a furnace by the quick method known as burning, energy food in our bodies is oxidized by a much slower process. Lastly, A.F.S. states that pigs can eat a limited quantity of coal, unharmed. That doesn't prove that they derive energy from it. I've seen goats eat paper and birds eat gravel, so what?—H.W., New York City.

Benignant Peruser Indites Encomiastic Epistle

NOT long ago, I read an account of a meeting of scientists at which some one told the assembled highbrows that they would have to learn to describe their discoveries in understandable English, instead of in Mumbo-Jumbo jargon, if they expected to get anywhere. It made me realize how lucky I am to have P.S.M. to keep me posted on the latest developments in science, written so I know what it's all about. None of your two-dollar words for me!—R.A.P., Utica, N. Y.

A One-Way Journey with No Stopovers

THE article in your July issue, pointing out that machines of war are tending more and more toward small size, holds water all right, according to my way of thinking. And the illustrations give a fine idea of how they'll be used. I wonder, however, about those winged bombs which "are aimed directly at their objective by lone pilots who then bail out with their parachutes." After all, to score a hit, the dare-devil aëronaut would have to stay with his mount almost to the very last moment. He jumps! Then what? He's sure to land in the hands of the enemy. He stands a good chance of setting down in the midst of the wreckage his winged bomb has created. There, he

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may burn alive. He'll surely be shot if he doesn't. He might better stay with his mount and ride it into its objective, where his own end would be, at least, mercifully swift. Are we to suppose that volunteers will enlist in the country's service with the foreknowledge that they are to "fight" this way?—T.N.O., Boonton, N. J.

Leg Guards for Milkmaids Have the Farmers Kicking

How'RE you going to keep the farm boys down on the farm if the hired girls start wearing "dairy leg guards" like the one you show in page 46 of your July issue? I'll bet that idea was thought up by some city slicker who doesn't give a hoot what becomes of agriculture. Let him put a pair of those wooden leggings on his stenographer for a few days, and see how he likes it.—R.E., Dodge City, Kans.

He'll See His Fireworks And Have Them Too

THANKS for the tips in your latest issue on how to make good photographs of aerial fireworks. I intend to take a lot this year. Meanwhile, I have been using the instructions to aid me in taking night shots of lightning. The results have been spectacular. I never realized before how much the camera can see that our eyes cannot.—F.A.H., Philadelphia, Pa.

But Ants Are Bloodthirsty Little Creatures, Too

ALL this war stuff is giving me the jitters. Let's have a quiet, soothing article about life in an ant colony.—D.R., Richmond, Va.

Voice Teacher Hopes That Many Will Read Article on Speech

ALLOW me to express the pleasure I have had in reading your article on investigations into matters concerning the voice, "Odd Laboratory Tests Show How We Speak," and the hope that it will be widely read in this country. My attention was called to it by a professor of singing, and writer on the voice. I quite agree that ignorance of the vocal mechanism has been widespread, but there has been a good deal of knowledge in certain quarters all the same, though it was difficult for the possessors of it to obtain a hearing. I have often (I am seventy-five, and have been teaching singing all my life) put both my thumbs or a bundle of lint into the cavity of my hard palate to demonstrate to pupils the truth about resonance there. I was for twenty years actively engaged in the direction of an organ factory, building pipe organs so solving problems of wind, resonance, and so on, was part of my work.—J.M.L., London, England.

Secrets of Success

STORIES THAT WILL HELP YOU GET AHEAD

PREPARATION MADE THE EXAMS EASY

AT THIRTEEN years of age, I went into the coal mines in Missouri, just a husky boy with a fourth-grade education. At twenty, I emerged from the mine for the last time, with no more book learning than I had when I entered seven years before. My seven years of hard labor had taught me only one fact; but it was one of value to me. I must acquire knowledge and education if I hoped to escape the undesirable life of the poorly paid day laborer. With such thoughts in mind, I started to the East with my seven years' savings, totaling about $100. At St. Louis, Mo., I trucked mail for six months, then followed telephone-line work for a year or less, but I was not contented. I wanted something better. I had tried for other things but, always, lack of education held me back. I was handicapped badly. The only school that I had attended was one of the type known to the pioneers of the '90s as the "little red schoolhouse." It had one teacher and eighty-odd pupils, ranging in age from six to forty.

For months I remained in a quandary. I wanted to do something about my education, but didn't know how to go about it. I must get some special training, a trade, a profession, or at least some knowledge, somehow. But how to get it perplexed me.

In just this frame of mind, my chance came to me out of a clear sky at a ball game. I was glancing through my newspaper between innings when my eyes fell on an advertisement. "Prepare Yourself for Civil Service Position by Correspondence Course." I tore out the ad and placed it in my bill fold. I knew then and there that I had something. I was certain of a means to an end.

I immediately took steps to begin studying for the next railway mail clerks' examination, which was scheduled to be held in St. Louis the following September.

I enrolled in the ——— School, studied hard, and the school gave me every possible coaching and training. I had returned approximately fifteen lessons by the time the date for appearing before the civil-service examiners arrived. During the examination, I was never worried after the first subject had been disposed of. My average of 94.60 won for me an early appointment as subclerk, and in due time came my regular appointment. I continued on through the higher railway-mail grades without difficulty.

Many of the boys with high-school diplomas, and others with college degrees, either failed to make the passing grade, or their appointments never reached their names, low on the eligible register. The men who made the higher

Secrets of Success

averages, and who subsequently received the early appointments, had prepared themselves by correspondence courses especially suited to their needs.

My various assignments took me pretty well over the world. A period of a few years I spent in charge of mails with the Army in France, during the World War, and later with the Army of Occupation, in Germany. The railway post offices I have served in would be too numerous to mention here, but they covered much territory and a vast distribution of United States and European mails.

I have forgotten the coal mines and other laborious lines of work, and just now, at fifty-three, I am preparing for something still higher than railway mail service. I have a special course paid for in the ——— ——— Schools, and shall start to work on that right away.

For all this I am thankful, and always will be, to the correspondence school that prepared me so thoroughly for my first civil-service examination. It was the very thing that I needed to get out of a rut and get started up hill. All I had to do was answer that ad and study hard for about three months. I was certain of success from the start. —*J. J. D., Kansas City, Mo.*

BARBER FOR YEARS, WON COLLEGE JOB

TEN YEARS ago, I worked in a barber shop. I spent ten hours a day, and, on Saturday, fourteen and fifteen hours, cutting hair and shaving people for my living. For years I had stood behind a barber chair, calling "Next," and hoping the customer sitting in the waiting line would see fit to get in my chair. We were paid a commission on what we took in. On Sundays, I went out to preach in the little Baptist churches scattered through the mountains near where I lived.

Today, I am director of publicity of the ——— ——— College. My work averages eight hours a day, and, although it does not mean I work any the less, I am practically my own boss.

As a barber, I earned only about twenty dollars a week, if I was fortunate and the weather was good. It doesn't matter, so far as my story is concerned, just what my present salary is. It is sufficient to say that there is no comparison between it and the old salary of barber-shop days.

I now move socially in the best of circles. I rub elbows with college-trained men and women with no thought of embarrassment, feeling perfectly at home in practically any discussion. And while it may sound like a patent-medicine advertisement, it is true that I owe my present standing and position entirely to self-improvement through home-study courses.

When I first became interested in home-study courses ten years ago, I answered an advertisement and took

Secrets of Success

the course in newspaper writing offered by the ——— School. After completing the course, I became correspondent for several newspapers. In 1930, I left the barber shop and accepted the position of general secretary of the Y.M.C.A., at ———. Seeing my need of more education, I took a high-school correspondence course from the ——— ——— School, and graduated in 1932.

With a daughter at ——— ——— College, I was unable to attend college myself. In order to become a better preacher, I enrolled in 1932 for the four-year course of the ——— School, continuing with my Y.M.C.A. and newspaper work.

I completed the course and graduated in 1936. In October of that year, I became staff correspondent for the ——— ——— "News," then resigned to accept a like position with the ——— "Times," three months later. When offered my present position early this year, I accepted.

In conclusion, let me say that I would never have learned enough about newspaper work to become acceptable to outstanding newspapers if it had not been for the correspondence courses I took. And my diploma, coupled with my newspaper training, was largely responsible for my securing the position I now hold.—*C. L. R. Cleveland, Tenn.*

More $5 Prize Winners

TWO prize-winning letters in POPULAR SCIENCE MONTHLY'S Secrets of Success contest—"*What Home Study Has Meant to Me*"—are printed above. Read these stories carefully, because your own career may be just as interesting and inspiring to other readers. If you think so, put it down on paper and send it in. We will pay $5 for every letter we publish.

Contest Rules

Only letters from bona fide home-study school students will be considered and these must contain the name of the school and the name of the company, or companies, for which you have worked since graduation. (Names, however, will be deleted from the letters when published.) We also want to know the kind of course you took and the type of position you have held. Your own identity will be kept anonymous, if desired.

We are interested in facts, not literary ability, but please write clearly, completely, and keep your letters within 750 words. We are not looking for "get-rich-quick" stories or freak adventures, and authors must be prepared to substantiate the truth of their statements. Manuscripts submitted and printed become the property of this magazine, and we are not responsible for the return of rejected letters unless sufficient postage is provided for this purpose. Address your contribution to Success Story, 353 Fourth Avenue, New York, N. Y.

SHIP MODELS
Make Perfect Gifts

A BEAUTIFUL ship model makes a perfect gift—it never wears out or becomes obsolete. If you would like to give one to a relative or close friend next Christmas, now is the time to start, particularly if you undertake one of the more elaborate models, such as the *Great Republic* shown above.

Our construction kits have been prepared to save you time and money. All the raw materials are of such sizes and shapes as to make it easiest for you to transform them into their final form, and a certain amount of preliminary shaping has been done on most of the hulls or hull lifts.

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4S. Clipper ship *Great Republic*, 31½-in. hull, 42 in. over all..... 8.40*

(Continued on page 18)

"Constitution" model built from Kit 3S

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☐ Commercial Refrigeration
☐ Welding, Electric and Gas
☐ Reading Shop Blueprints
☐ Sheet Metal Worker
☐ Machinist ☐ Toolmaker
☐ Patternmaker ☐ Boilermaker
☐ Heat Treatment of Metals
☐ Bridge Engineer
☐ Bridge and Building Foreman
☐ Highway Engineer
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☐ Surveying and Mapping
☐ Mechanical Engineering
☐ Mechanical Draftsman
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☐ Aviation Engines
☐ Auto Technician
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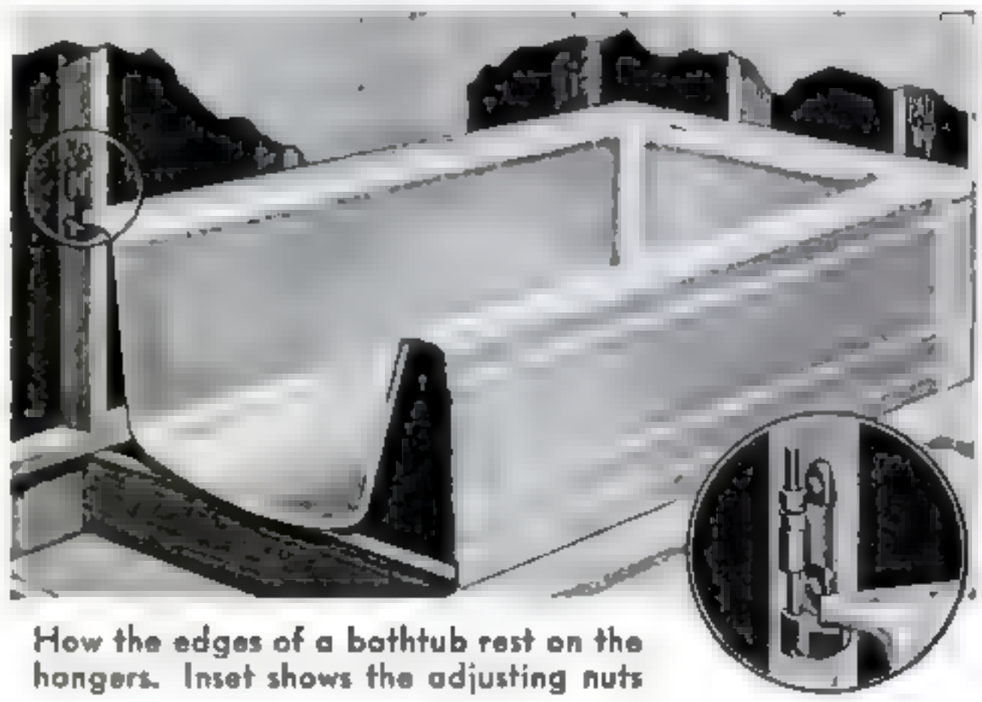
New Ideas for HOME OWNERS

•

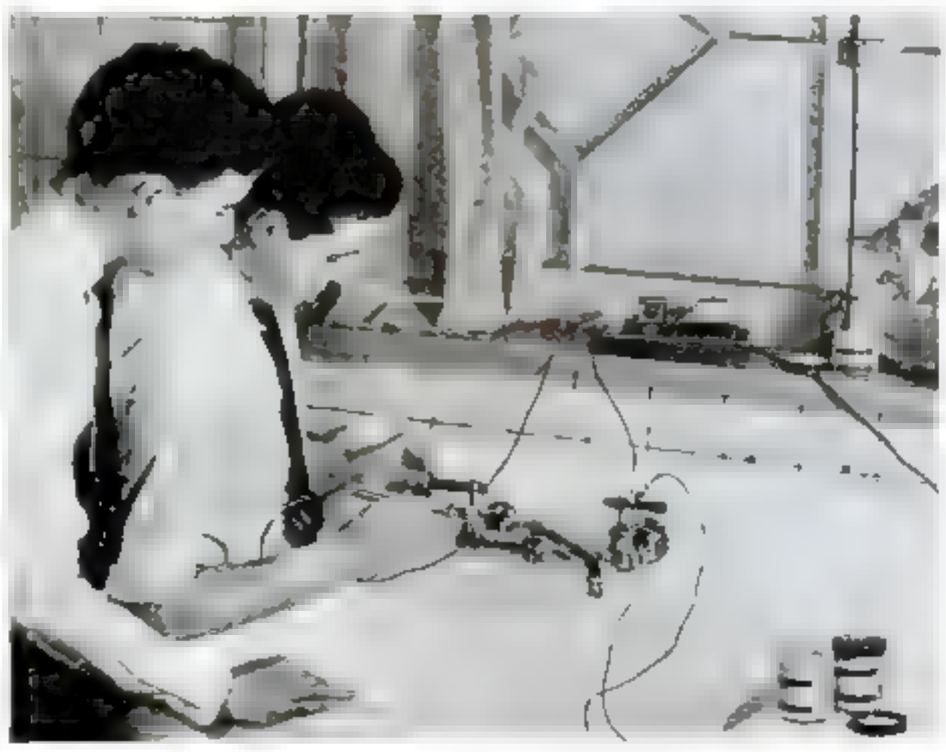
DOUBLE-COATED on both sides with a moistureproof bituminous compound, a new insulating sheathing is now available to home builders. According to the manufacturers, it has unusual strength and will not foul saws or other tools used in cutting it to shape. Available in sections four feet wide and from eight to twelve feet long, the panels, shown being installed in the photograph at the left, are marked for nailing so that they can be applied quickly and easily.

Hangers Prevent Bathtubs from Settling

QUICKLY leveling any type of built-in bathtub, an adjustable hanger simplifies installations and is said to insure against any future settling that might crack the surrounding tile or plaster. Two lag screws fasten each hanger to the wall studding. The edge of the tub rests on an adjustable arm on each hanger, which can be raised or lowered by convenient nuts to bring the tub to a level position.



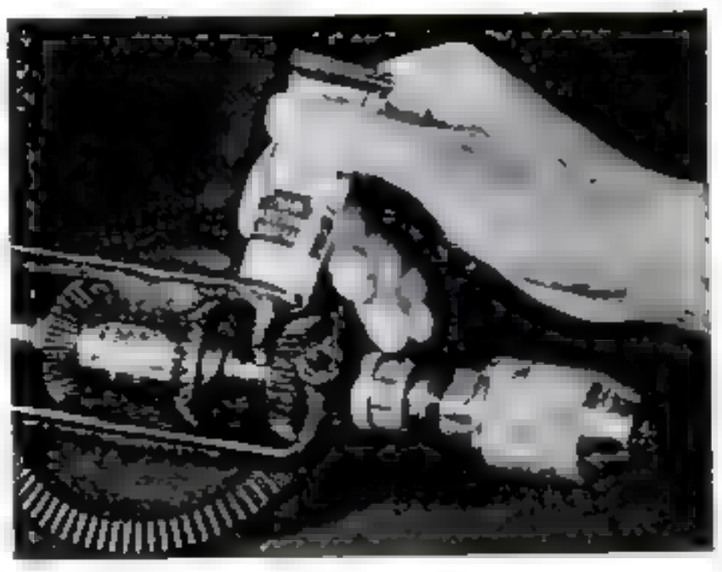
How the edges of a bathtub rest on the hangers. Inset shows the adjusting nuts



Nickel-plating a kitchen fixture with the electric brush

Electric Brush Plates Metals

JEWELRY, tableware, and plumbing fixtures can be quickly and inexpensively replated with a new electric kit just marketed. The user simply cleans the article, applies a paste containing the desired metal with an electric brush, and polishes it to a luster. The device is designed for alternating house current. Besides restoring finishes, the unit can be used to plate metal surfaces not previously so treated.



Light Lubricating Oil Now Comes in Tubes

HIGH-QUALITY lubricating oil of the type used for many years on bank safes and vaults is now available for general household use in a handy collapsible tube. Provided with an oil-can spout, the tube is squeezed lightly to eject the desired amount of oil, which is said to possess special rust-preventing properties and to flow easily at temperatures far below zero. Since oil is squeezed out, the tube does not have to be upended and oiling can therefore be done in an upward direction to reach difficult spots that defy ordinary oil cans.

Questions FROM HOME OWNERS

Q.—WHAT is the best method of finishing a concrete floor in a play room? It will have to withstand marring by steel skate rollers as well as scuffing by rubber-soled shoes.—E.J.B., Pewee Valley, Ky.

A.—WE SUGGEST that you use a special type of paint made with a so-called rubber-cement, waterproof base for finishing the concrete floor. Such a finish will be attractive yet will stand a considerable amount of very hard wear.

Patching Chipped Enamel

Q.—PATCHES of enamel have chipped off the surface of our refrigerator and washing machine. Is there any way to refinish and repair the enamel without scraping the entire surfaces down to the metal?—L.A.G., Blackwell, Okla.

A.—CHIPPED enamel can be repaired with the use of a special porcelain cement available to home owners. The chipped surface is cleaned and warmed, and the cement, which resembles sealing wax, is applied with a warm knife.

Leak in Hot-Water Tank

G.F.H., BINGHAMTON, N.Y. A small leak in a hot-water tank can be plugged easily by inserting a tapered stopper of white pine or walnut into the hole. The taper should be a gradual one, terminating in a point as sharp as a needle. Soak the plug in water, and then drive it in with a hammer. Cut off the projecting end within a half inch of the outside of the tank.

Classified Section

CLASSIFIED ADVERTISING is inserted in these columns at the special rates of: 20c a word per insertion for 12 consecutive issues, 25c a word for 6 consecutive issues, 30c a word for 3 consecutive issues, 35c a word for one issue. Minimum ad accepted is 10 words. Each insertion is payable in advance. Copy and remittance for the September issue (on sale August First) must reach this office not later than *July Third*.

POPULAR SCIENCE MONTHLY, 353 FOURTH AVE., NEW YORK CITY

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MAIL-ORDER ad reaching 1,500 000 families throughout United States $15.40 inch. Newspaper, magazine, ratebook free. Chicago Advertising Agency, 20-PS West Jackson, Chicago.

ADVERTISE: 24 words in 250 newspapers $10. Lists free. Advertising Bureau, 4515-P Cottage Grove, Chicago.

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INCH display advertisement 30 magazines year $24. Wood's Popular Services, Atlantic City, (N. J.)

24 WORDS 65 newspapers, magazines $3.00. Goodall, 742 Market, San Francisco.

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BIG profit—Sell latest auto specialty. Up to 300% profit. Wildfire rep[illegible] Details free or send $1.00 for full sample. Nu-Way Products Co., 302½-B South Front St., Mankato, Minn.

AGENTS—Opportunity make money; book containing 107 successful business plans home-office, send for free introductory booklet. Elite Co, 214-A Grand St., N. Y.

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SCIENTIFIC gas economizer increases mileage 25-40%. Trial package $1 00, enough to treat 120 gallons. Norsemen Chemicals, Crete, Nebr.

EXCLUSIVE representatives appointed Faucet water softener. Revolutionary. Luxusoft, Sausalito, Calif.

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CONVERT your car to burn Diesel oil. Save up to 70% fuel costs. Cheap installation. Wonderful performance. Proven factory method. Different and better. Costs nothing to investigate Write for free circular No. 3. Harrington Company, 201-204 Manchester Bldg, Portland Ore

AUTO Kinks—A service and repair manual for the auto owner who is not a mechanic. What to do no matter what goes wrong. Fully illustrated only $1 00 postage. Eugene Watson, Dept. C88, 353-4th Ave., New York

ECONOMY! Performance! Mileage! Semi-diesel conversions for gasoline motors. Manufacturers written guarantee Learn basic facts from free literature Houston & Logan Conversions, 2021 Grove St., Berkeley, Calif

SEMI-DIESEL conversions for auto. Other gasoline engines save 65% $5 up. Trial guarantee Agents wanted Diesigas, 355 Santa Clara, Oakland, Calif

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BUILD the famous, low-cost Jim Dandy Cabin Trailer. Complete plans and instructions 50c Plans to build the beautiful streamlined Jim Dandy Cabin Cruiser, $1 00. Trailer Builders Manual and catalog of trailer parts, supplies and equipment - over 100 interesting, illustrated pages. 25c Order today. Satisfaction guaranteed. Trailer Supply Co., 411-B Jackson St., Wausau, Wisc.

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Kits for Making Gifts

(Continued from page 11)

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(Continued on page 19)

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(Continued from page 18)

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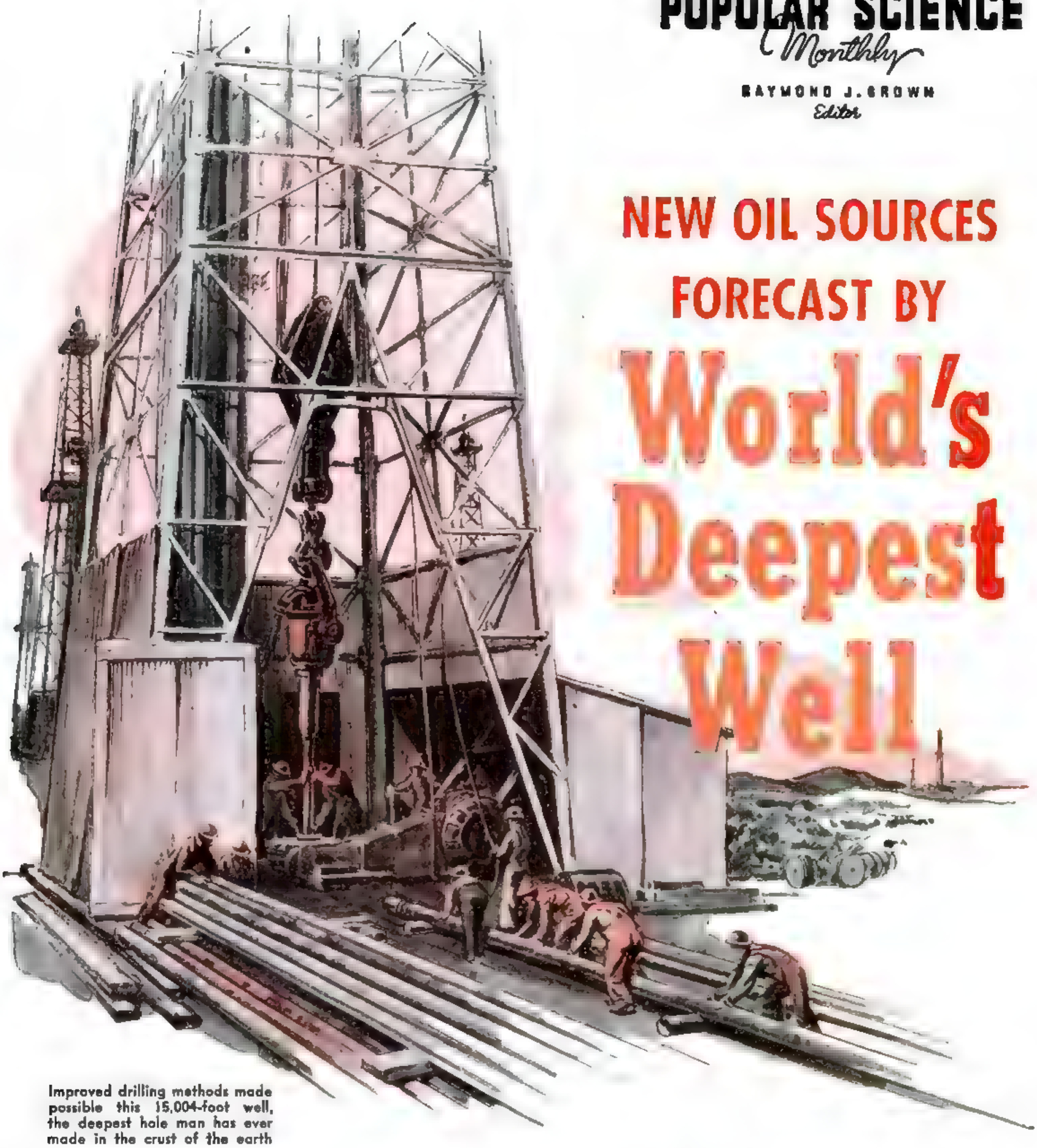
WINGS OF THE FLEET

Here are nine of Uncle Sam's naval scout-bombing planes in an unusual and difficult formation. Operating from an aircraft carrier, planes of this type could locate a hostile armada far at sea and strike it a swift, paralyzing blow

POPULAR SCIENCE
Monthly
RAYMOND J. BROWN
Editor

NEW OIL SOURCES FORECAST BY World's Deepest Well



Improved drilling methods made possible this 15,004-foot well, the deepest hole man has ever made in the crust of the earth

By JOHN E. LODGE

PLUMBING the earth's crust to a depth of nearly three miles—15,004 feet, to be exact—the deepest of all man-made holes has just been drilled near Wasco, Calif.

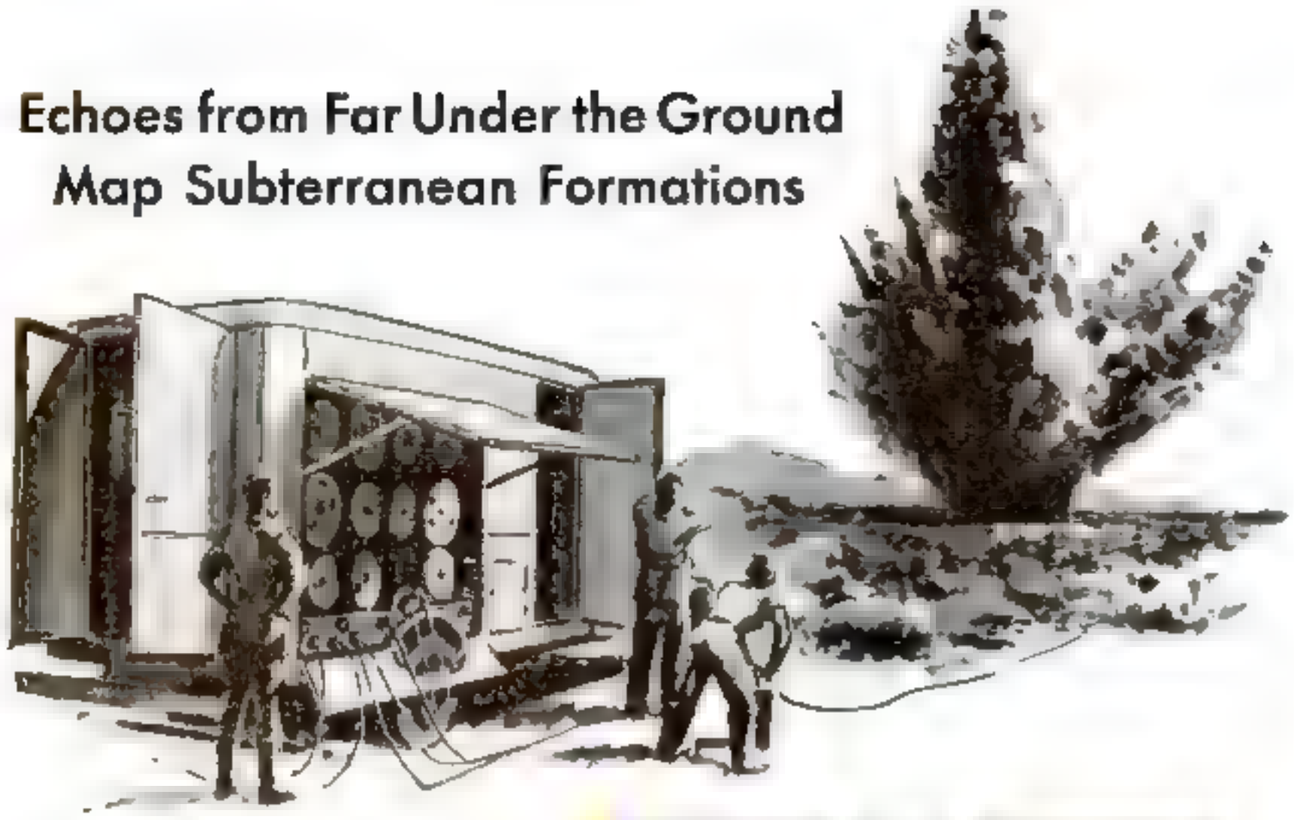
Downward it leads, through regions never before explored by geologists, through sands laid down by prehistoric oceans, twice as far toward the center of the earth as man has ever penetrated in the lowest levels of the world's mines. At its bottom, bearing witness to its approach to some fiery, subterranean inferno, it reaches the ovenlike temperature of 270 degrees. Solely as an observation post for learning the secrets of the earth's interior, the shaft would fire the imagination of any scientist.

What most interests the petroleum engineers who bored this extraordinary hole, however, is their success in using it to tap the deepest-lying oil ever brought to the surface of the earth. Enough "black gold" to fill a dozen tank cars daily now flows from its mouth—marking a triumph for oil-seeking methods that were unknown in the industry only a few years ago.

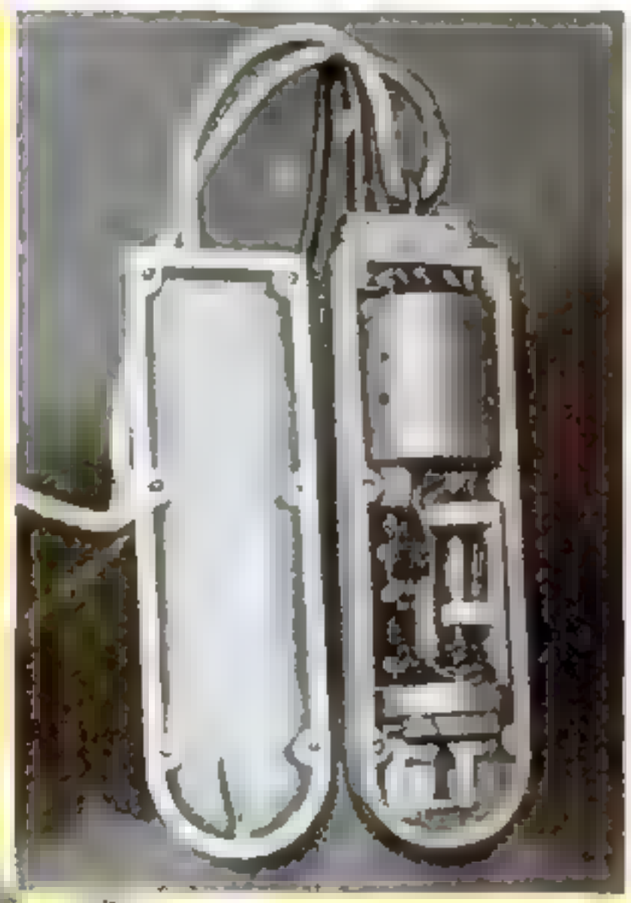
"KCL A-2," as the Continental Oil Company designates its record-breaking well, began as a wildcat or exploratory shaft—driven as much for the purpose of exploring the subterranean formations as in the hope of finding oil. When it finally passed the 15,000-foot goal of the drillers, not a drop of oil had been encountered! Once, that would have been the end of it; all the cost and labor would have been in vain, as far as striking oil was concerned.

But the men who drilled the "KCL A-2" had an ultra-modern aid at their

Echoes from Far Under the Ground Map Subterranean Formations



In an apparatus called a geosonograph, vibrations produced by an explosion and reflected by underground formations are picked up by buried detectors, like the one at the right, and used to chart possible oil pools



disposal, a strange device nicknamed the "electric probe." Into the well, they lowered a bullet-shaped electrode, attached to a huge reel of wire. By gauging the amount of current that flowed between this electrode and a second one, buried in the ground at the surface, the proximity of oil at any particular level could be detected. Telltale indications were obtained when 13,100 feet of cable had been paid out, although samples of sand brought up from this level during the drilling of the well had not exhibited the slightest oily color, odor, or taste. Apparently the well had just missed an oil pool, blocked off from it by a formation impervious to oil.

At this point, another of the latest scientific aids to oil men, the "underground machine gun," was called into play. Down the well on the end of a cable went a torpedo-shaped cylinder of steel, studded with recessed knobs along its outer shell. Each knob formed the barrel of a pistol. As the device reached the 13,100-foot level, a thousand feet below the former world's deepest "producer," an operator at the surface closed an electric switch. Slugs of solid steel punctured the well casing and ripped through the surrounding sand. As if released from a bullet-riddled tank, oil gushed through the holes and up the pipe, vindicating the "sixth sense" of the electric probe.

The new oil detector does for vertical oil hunting what other scientific divining rods have already done for mapping the horizontal boundaries of an oil field. And the instruments used for picking out the surface sites of oil wells, in their turn, have come in for recent refinements.

Until now, for example, a widely used system of mapping oil-bearing formations beneath the earth has consisted of exploding buried charges of dynamite, and using seismographs to record the artificial-earthquake waves reflected from the depths (P.S.M., Mar. '37, p. 40). For the seismographs, a new scientific prospector, called a "geosonograph," substitutes highly sensitive electrical detectors, of a crystal type originally developed for locating enemy submarines in wartime. Earth tremors picked up by these detectors, which are buried in the ground, are successively converted into electrical waves, flickering light, and permanent records on motion-picture sound film. An analyzer employing an electric eye then interprets the complex patterns of the film records, yielding data from which a draftsman can plot the course of subterranean layers or rock and sand with as much assurance as if they were actually exposed to view. Thus complete charts are obtained of oil fields like the one in which the "KCL A-2" well is situated, before any well-drilling begins. According to the inventor of the geosonograph, it extends the range of present prospecting instruments to reveal faults, fissures, and other formations far beyond the depth of present wells.

Deeper and deeper shafts for oil, however, heighten the problem of getting it to the surface. For a while, nature may take care of the matter by providing pockets of natural gas under sufficient pressure to force the oil up through the thousands of feet of pipe. But as oil is constantly withdrawn, the gas pressure drops, and wells have had to be abandoned with millions of barrels of oil still in the ground.

To prevent this, experts have recently perfected a process of "pressure maintenance" described not long ago by E. O. Bennett, chief engineer of the company that drilled the "KCL A-2," before a meet-

Oil from the ocean floor. This well, located in the Gulf of Mexico, was drilled from a sunken barge. Subterranean explosions punctured oil-bearing sands to start the flow

ing held by the American Petroleum Institute. The idea is an outgrowth of the scheme of reviving oil wells that have ceased to flow by "repressuring" —that is, by pumping air or gas back into the underground formation to restore the pressure. In the newer "pressure maintenance" plan, however, oil wells are never allowed to reach a point where repressuring is required. The stimulating injections proceed simultaneously with the piping off of the oil.

Through an ingeniously designed set of separators, a modern pressure-maintenance system draws off the natural gas that comes to the surface with the oil. The vapor is treated for the recovery of gasoline and other by-products. Then powerful compressors pump the remaining "dry gas" back into the ground—either through a separate pipe in the same well, or through an "input well" reserved for the purpose—to aid in raising more oil and more gasoline-bearing gas. The final result, when all the oil and liquid by-products have been recovered from the underground pool, is a vast subterranean reservoir of natural gas which may then be profitably tapped and used for fuel. Nearly half again as much oil may be recovered from a typical field where this method of conservation is practiced, it is claimed.

For deep wells, the "pressure-maintenance" system has another advantage. Brought from levels where terrific heat and pressure conflict to form strange borderland compounds, midway between liquids and gas, oil may change from one form to another on its way to the surface. Oil lines may even be clogged with solid paraffin as the rising oil expands and cools under reduced pressure. The new system provides a delicate means of pressure control that obviates these difficulties.

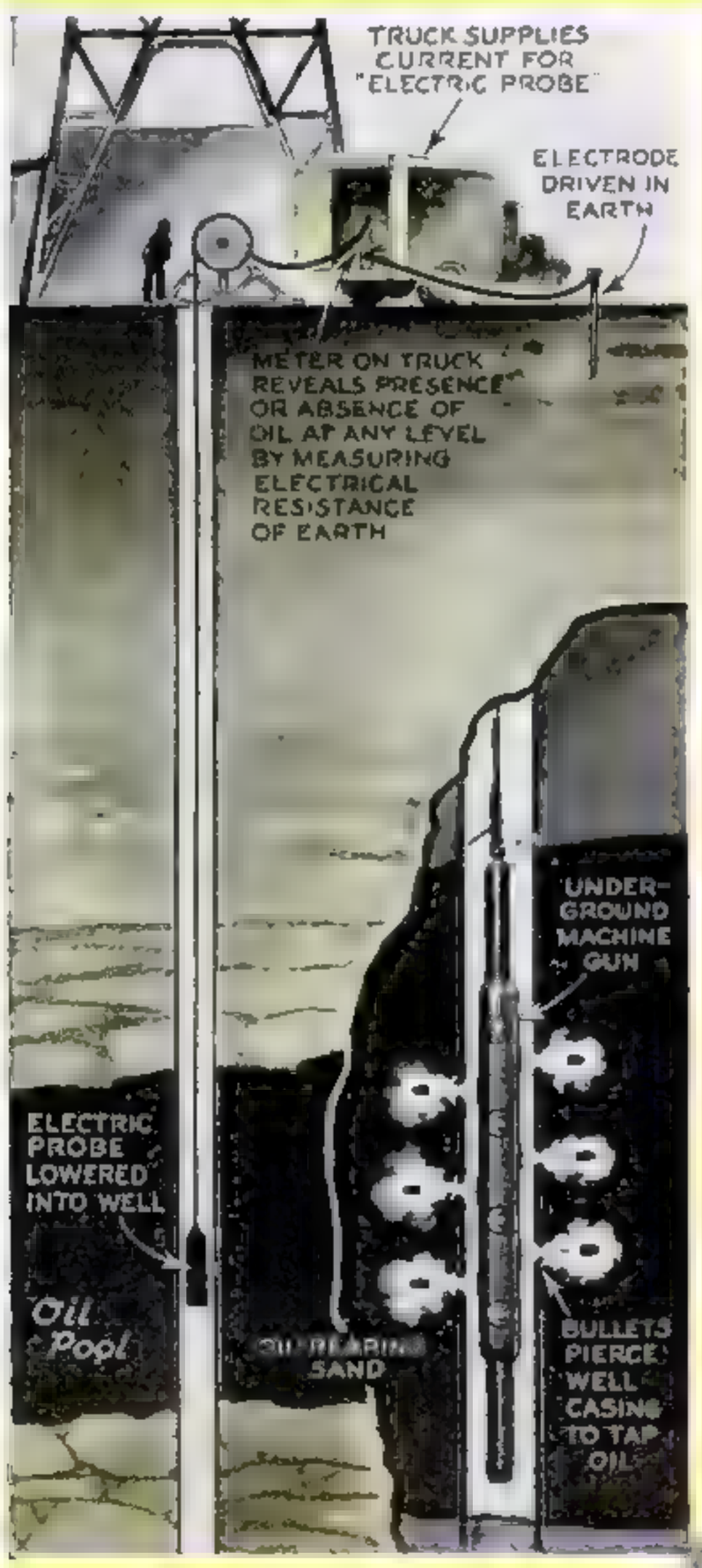
In applying the pressure-maintenance plan, engineers have succeeded in returning through a single well, daily, as much as 15,000,000 cubic feet of gas, or twice enough to fill the largest airship ever built. They have pumped gas into the ground at pressures up to a recent maximum of 4,600 pounds to the square inch, a pressure that not even the most heavily armored diving suit could withstand. Thus the strength of man-made machinery has been pitted against the titanic forces of the depths of the earth—and has won. The new achievement removes the last obstacle to reaching vast stores of liquid gold at record depths, miles beneath the ground we walk on.

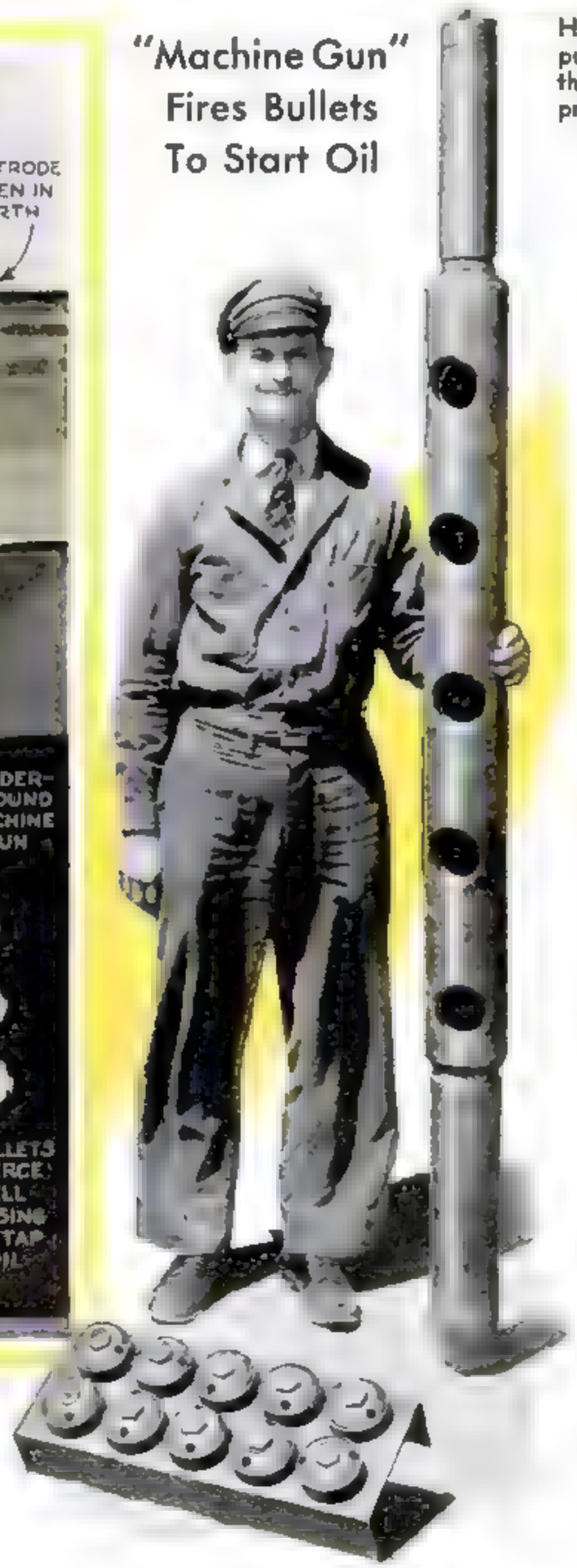
Look backward less than a quarter of a century, and you will realize what an advance has been made when it is even mechanically possible to bore a hole nearly three miles deep. In 1915, drillers at Charleston, S. C., sank a well to what was then a world-record depth—2,000 feet. In 1926, a well at Brea, Calif., reached 8,000 feet. A race for the 10,000-foot level was won in 1931 by a well near Seacliff, Calif.

Now engineers began to speculate, for the first time, as to the possibility of reaching 15,000 feet. They got out their pencils and found that enough sections of pipe to reach this level, screwed end to end to twist the drill, would weigh 200 tons. Could a derrick be designed that would shoulder the staggering load—and then lower into the well an even heavier length of alloy-steel casing? Could engines be built that would handle such dead weights, and still turn a drill miles away with velvety smoothness and delicate control? Insuperable as the difficulties seemed at the time, forward-looking experts conceded that some day it might be done. Today the 15,004-foot "KCL A-2" is the realization of their dream, and the likely forerunner of still deeper shafts to come.

How natural gas is separated from oil and then pumped back into the ground. This maintains the pressure that is necessary for maximum production and prevents shifting of formations

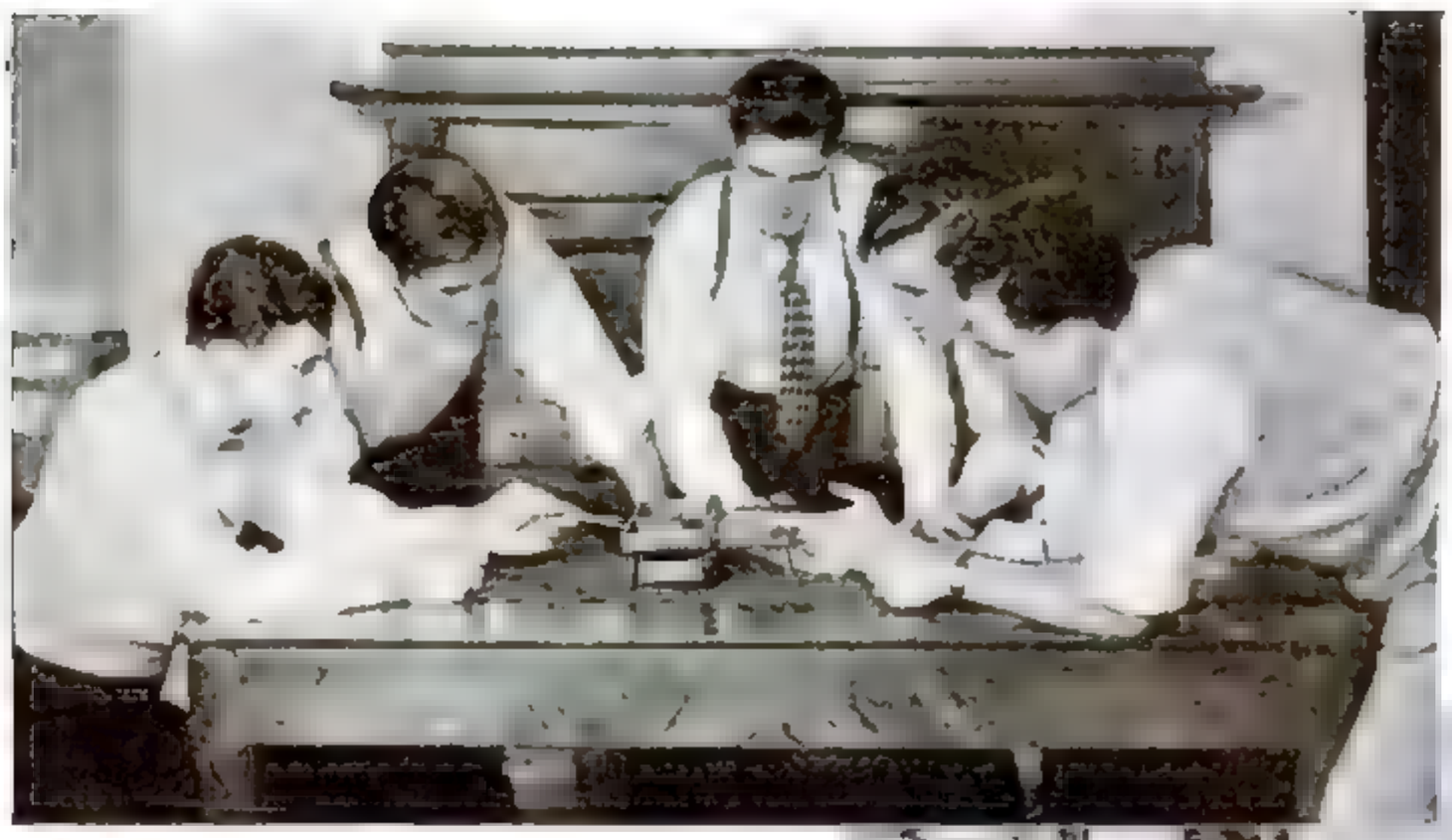
"Machine Gun" Fires Bullets To Start Oil





FINDING THE OIL LEVEL. When the electric probe has shown the level in a well at which oil is present, the exploding perforator seen at right is lowered to that point. It shoots bullets from the cartridges shown, tearing paths for oil

Big Business



In their office, boys of this Junior Achievement "company" are discussing production methods best suited to a project. Later, in the shop at right, they apply their plans, making articles

HOW YOUNGSTERS ORGANIZE AND RUN CRAFTWORK COMPANIES THAT TEACH BUSINESS METHODS AND PAY STOCKHOLDERS DIVIDENDS

By Kenneth M. Swezey

WORKING in cellars and neighborhood clubs, in attics, barns, churches, and spare rooms of private homes, more than 20,000 American boys and girls between the ages of sixteen and twenty-one are conducting an amazing big-business venture in miniature. As members of the Junior Achievement movement, with fifty units or "companies" in New York City alone, and 1,000 more scattered through cities along the Atlantic Coast and as far west as Denver, Colo., these young craftsmen are not only creating things of usefulness and beauty, but, in conducting their business, are also thoroughly grounding themselves in modern merchandising and business administration.

During the present year, these companies will probably gross nearly a third of a million dollars, derived entirely from articles they have made and sold. In times when many established adult business houses may falter and fail, all these junior companies expect to meet their expenses, including rents and wages, and wind up with enough profit to buy additional equipment. And a good many of them will declare a ten-percent dividend to stockholders!

But, immediate cash returns are only an incidental phase in the work of these ambitious organizations. Training for life and work, through practical experience, comes first. Horace A. Moses, head of a large paper company, and the late Theodore N. Vail, telephone magnate, had enough faith in the idea to contribute $250,000 each to help found the organization. Now, several large industrial and business concerns have standing regulations that all new young employees be recruited from Junior Achievement companies. Other concerns are sponsoring units among their own employees.

How does it work? Just like any regular manufacturing corporation, except in scale. A group of older boys, girls, or both, decide they would like to start a company for making furniture, say, or fine leather work, or hammered pewter. Four adults agree to coöperate with them: a business man, a crafts leader (often an experienced home-workshop hobbyist or a manual-training teacher in a local school), a sales counsel, and a chairman. These four make up the advisory committee. President, treasurer, production manager, sales manager, advertising man, and secretary are chosen from the company membership, while all members are directors. For the sake of close coöperation, companies generally have but fifteen members.

Although he punches leather in the shop, this young worker, like all of his associates, is a company official

After a name and trade mark have been chosen, and the company has been incorporated, tools must be bought and the rent paid for a meeting place. A cash surplus must remain for materials and emergency expenses. Different crafts require different capitalization. Metal working, woodworking, and leathercraft, require fifty dollars each; paper working and needleworking about

in Miniature

twenty-five dollars; while a company for working in wrought iron may need seventy-five dollars. This capital, just as in big business, is raised by selling stock to members of the company and their friends. Twenty-five or fifty cents may buy a share, and, so that no one person will have a controlling interest, no one may buy more than five or ten shares.

Then the company starts operation. The boy and girl members run it with only as much guidance and advice as they may desire from their adult partners. Junior Achievement headquarters, in Springfield, Mass., New York City, Philadelphia, and other cities, suggest programs, act as clearing houses for projects and designs, and maintain completely equipped schools for training both craft and business workers.

A company may tackle any craft. "The Anvil," a company in Jamaica, N. Y., is doing a rushing business in sterling-silver jewelry and other small-article metal work. "The Printcrafters," in a neighboring place, handle a nice bit of the card, letterhead, handbill, and similar small presswork of the community. "The Knick-Knacks," a unit of girls, all employed by a large insurance company in New York City, turn out hosts of pins, brooches, candlesticks, napkin rings, and the like from plastic material, besides handling a line of needlework.

Projects are as varied as the groups, and may range from a simple key ring or bookmark, to a fine leather desk set for an exclusive club, or built-in bookcases for an entire room. One large project was an elaborate doll house, four feet high, and furnished to the last minute bit of upholstery and to its tiny brass candlesticks. Completed, it weighed more than a ton.

Work must be sold in competition with regular commercial products on a quality basis, so there can be nothing

Customers may view the work produced by this company in its well-designed display shop. Here a prospective buyer examines a composition plaque, priced to bring a fair profit

Trade marks such as these identify each of the self-supporting midget businesses

amateurish or cheap about it. The members design their articles carefully to meet modern trends. When a design is approved by all of the members, a sample is made, and its cost is carefully checked. Time, material, overhead, depreciation of tools, and profit, are all considered in the calculation. If the estimated price of an article seems reasonable, regular production may begin. Well-known industrial designers, architects, and artists often judge the merits of a striking design or of a project that might be distributed to groups throughout the entire organization.

There are no labor disputes in these junior companies, because every worker soon learns the financial problems of his own concern, and can himself compute to the penny what his work is worth. Depending upon workers' ability and the cost of the materials of the product being made, wages may run from five to thirty cents an hour. In some companies the workers are so proud of their growing achievements that they voluntarily turn back their wages to help buy new equipment.

Selling generally is done direct to the customers, and unusual articles are often made to customers' specifications. Each member of the firm must take his turn with the sales kit, and bring in his share of new business. In this way, patronage is gradually built up.

After several years of operation, most companies become so successful that the members try to buy in all the outstanding stock, so that they themselves may reap the dividends. The stock of one company, that sold for fifty cents a share seven years ago, is now quoted proudly at a dollar fifteen. In a number of companies business has become so pressing that the members have given up their regular occupations and have established full-time, going concerns.

Girls alone conduct the shop at left, using modern business methods and turning out a line of highly saleable plastic novelties

Plane Takes Off and Lands on Speeding Auto

TAKING OFF from the top of a speeding automobile and alighting again upon it, a dare-devil stunt pilot recently thrilled spectators at the Oakland Airport in California. A wooden platform mounted on top of the car offered barely enough room for the plane at rest, requiring the most skillful piloting and teamwork with the driver of the car for the hair-raising feat of a landing. In the picture at the right, the plane can be seen settling onto its tiny "landing field."

It took skillful handling to bring this plane down on the narrow platform built over the car top

Spring Heels for Shoes

A SPRINGY step is assured the wearers of sports shoes created by a Los Angeles, Calif., designer. Instead of conventional heels, the novel footwear employs resilient coil springs, which are said to absorb shocks and prevent fatigue.

Cigarette Match Holder

MATCHES are always handy when they are attached to a cigarette package with the new holder illustrated. With the transparent wrapper removed from the package, the aluminum holder for match books slips into place as shown.

Dwarf Flowers Grow in Table-Top Garden

ANY child can plant a table-top flower garden that really grows, with an outfit just placed on the market. Ornamented in the style of the popular movie, "Snow White and the Seven Dwarfs," the miniature set provides a metal box with specially treated soil, white gravel for making a path, and the seeds of four dwarf varieties of flowering plants, together with complete instructions for planting and care. When in bloom, the miniature garden is a beautiful decoration for a room.

Miniature garden in bloom and, right, the set as purchased with specially treated soil and dwarf flower seeds

New ultra-violet lamp in use for treating the skin of the hand

Ultra-Violet Lamp Has Glass "Window"

ULTRA-VIOLET rays stream from a bulb of common glass, in a lamp developed by Westinghouse engineers for treating skin disorders. Special materials like quartz have previously been employed, because glass is ordinarily opaque to the rays, but an extra-thin "window" blown into the new bulb transmits them effectively.

Odd Blimps Hold Net To Snare Bombers

RESEMBLING a herd of flying elephants, grotesque captive balloons are being tested in England as a means of combating possible air raids on London. The weird balloons, anchored to special trucks by steel cables and drifting upward as high as 25,000 feet, support a great steel net. Raiding planes, it is believed, will strike and become entangled in the net before they can release bombs on vital municipal areas.

Four of the "flying elephants" that will spread a net of steel in the sky around London, England

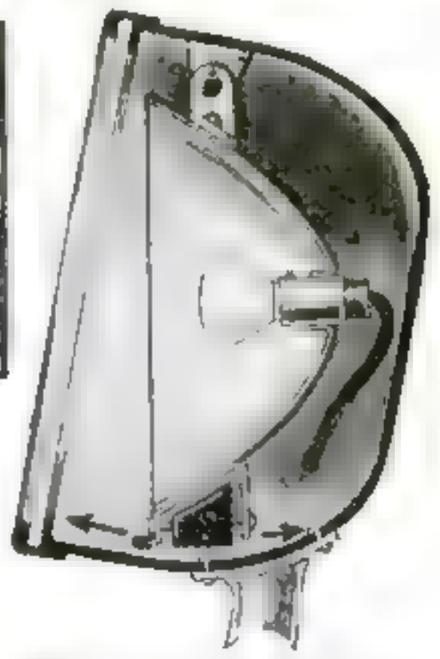
"Lost-Chord" Fiddle Plays 300-Tone Scale

A NOVEL musical instrument invented by Paul W. Thomas of Oklahoma City, Okla., is said to produce at least 300 tones within the range of the thirteen-note piano octave. Strung across a metal frame, seven steel strings are either plucked, struck with a hammer, or bowed. Magnetic pick-ups reproduce the sound in a loudspeaker. Overtones, which on other instruments blend together, can be separated and sounded individually, it is claimed.

Paul W. Thomas playing the novel instrument on which separate overtones are sounded

Headlight Tilts on Hills

SWINGING inside the lamp housing, a reflector unit for automobile headlights automatically throws the light rays down onto the road as the car climbs a hill. The reflector is hung on a pivot so that gravity keeps it vertical, reducing the danger of blinding the drivers of other cars.



Pivoted at the top, the reflector remains vertical as the car climbs a steep hill

Bait Seller Supplies Movie Insect Plague

SELLING grasshoppers for anglers to use as bait is the odd business of Cliff Jones, of Hollywood, Calif. Recently, when a movie director needed 7,000,000 live 'hoppers for an insect-plague scene, Jones made a quick trip to Utah and came back with thirty-five barrels of the insects within the two weeks' time specified by the odd order. After their film debut, the grasshoppers were killed.

Cliff Jones with 'hoppers boxed for bait

Camera on Police Gun "Shoots" Criminals in Action

Test of revolver camera, and three "shots" made by it

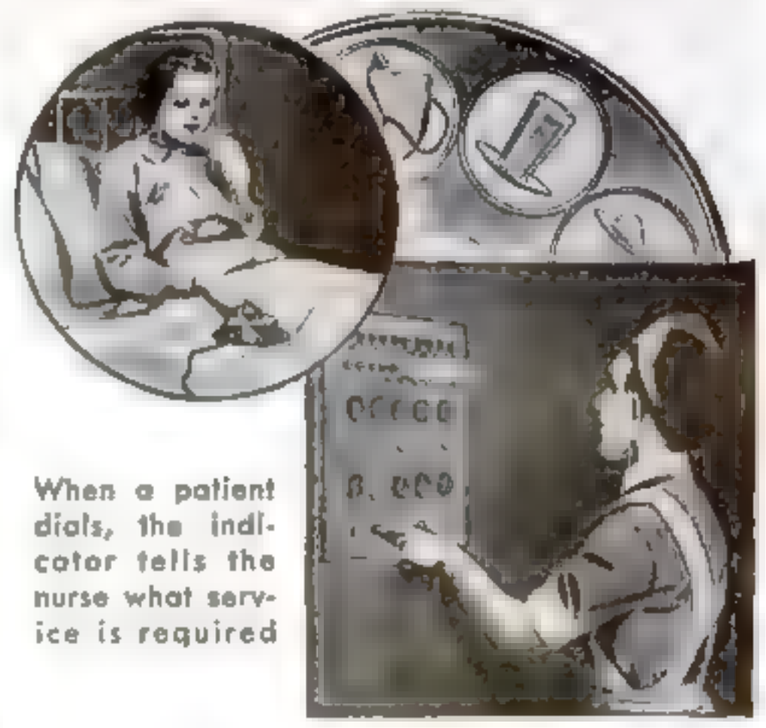
FASTENED below the barrel of a revolver, a tiny gun camera devised by Abraham Kurnick of New York City is less than two inches long and weighs only six ounces, including its special lens. Both shutter action and the turning of the film are automatically controlled by the gun trigger. Designed for police use, the camera enables an officer to photograph a criminal in case a shot misses.

Pulling the trigger of the gun opens the camera shutter and also turns the film. Upper picture shows the six-sided spool on which the half dozen exposures are made

Electric Ear Tests Musical Instruments

Measuring pitch of a clarinet. At right, one of the twelve stroboscope disks used

MUSICAL pitch is accurately measured with the eye in a new electrical machine that operates on the principle of the stroboscope, or stop-motion device. When a given note is sounded into a microphone, a whirling disk appears to stand still if the pitch is exactly correct. If the note is sharp, the disk appears to rotate to the right and, if flat, to the left. The amount of sharpness or flatness is determined by turning a knob until the disk appears stationary, and reading a dial.



When a patient dials, the indicator tells the nurse what service is required

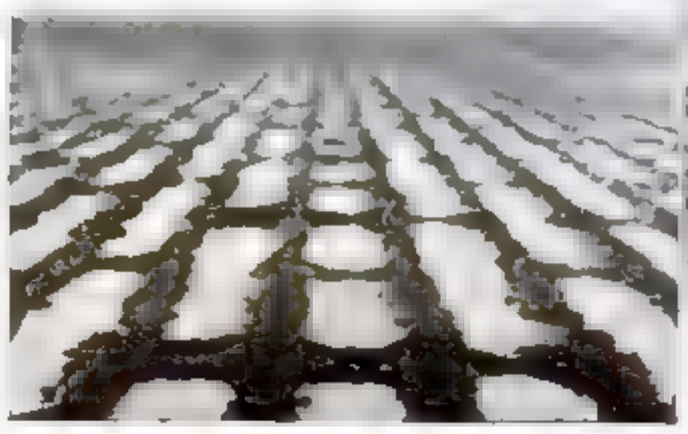
Patient Dials Needs

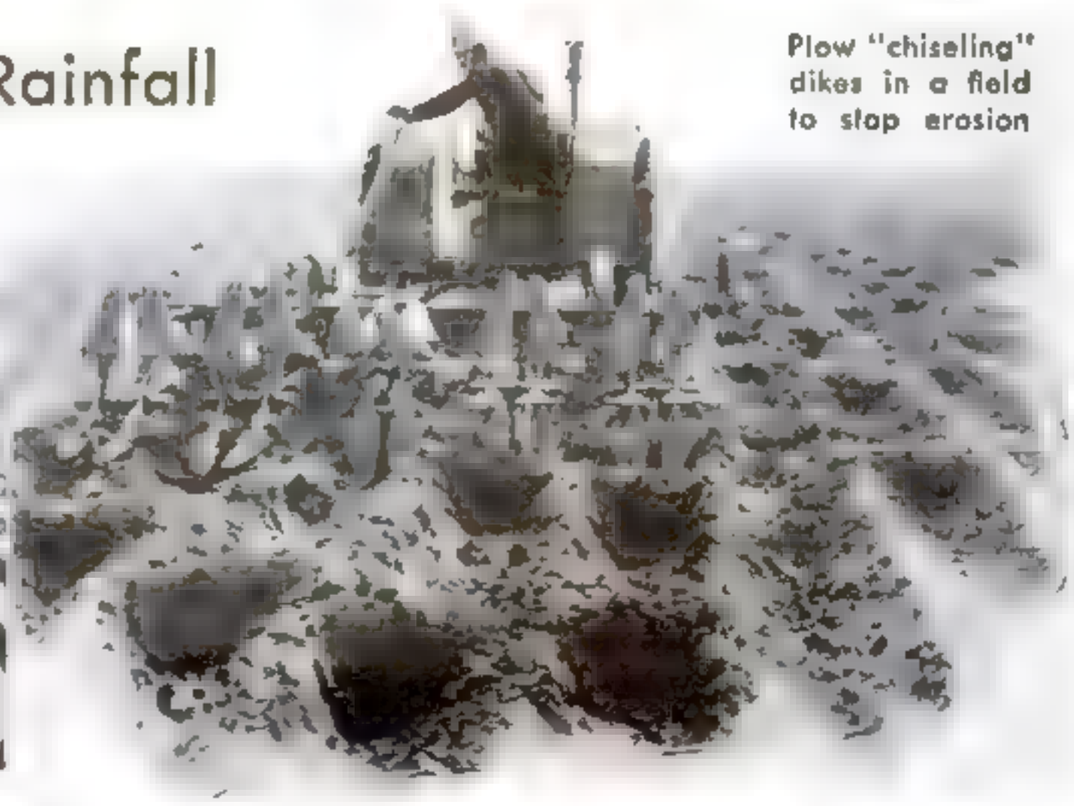
SYMBOLS on the bedside dials of a new hospital signaling system represent the ten most frequent needs of patients. By selecting a symbol and flipping the dial, the patient makes any desire known.

Dust-Bowl Plow Digs Dikes To Hold Rainfall

COMBINING the work of a shovel and a plow, a new cultivating machine invented by C. T. Peacock, Arriba, Colo., farmer, digs a checkerboard pattern of dikes in a field to hold rain water and check erosion. Specially designed for "dust-bowl" areas where rainfall is scanty, the system prevents surface water from running off the soil and collecting in low spots by holding it in miniature dams so that it will soak into the ground at all points. The treatment is also said to check wind erosion.

Below, rain water caught and held in shallow ditches

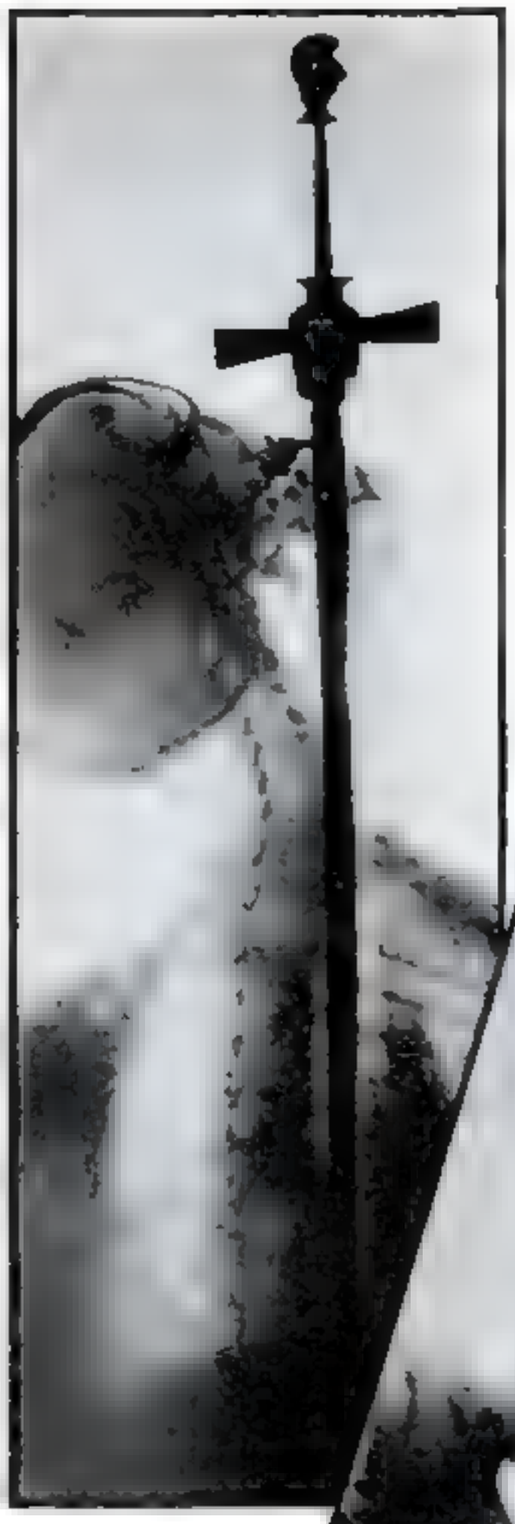




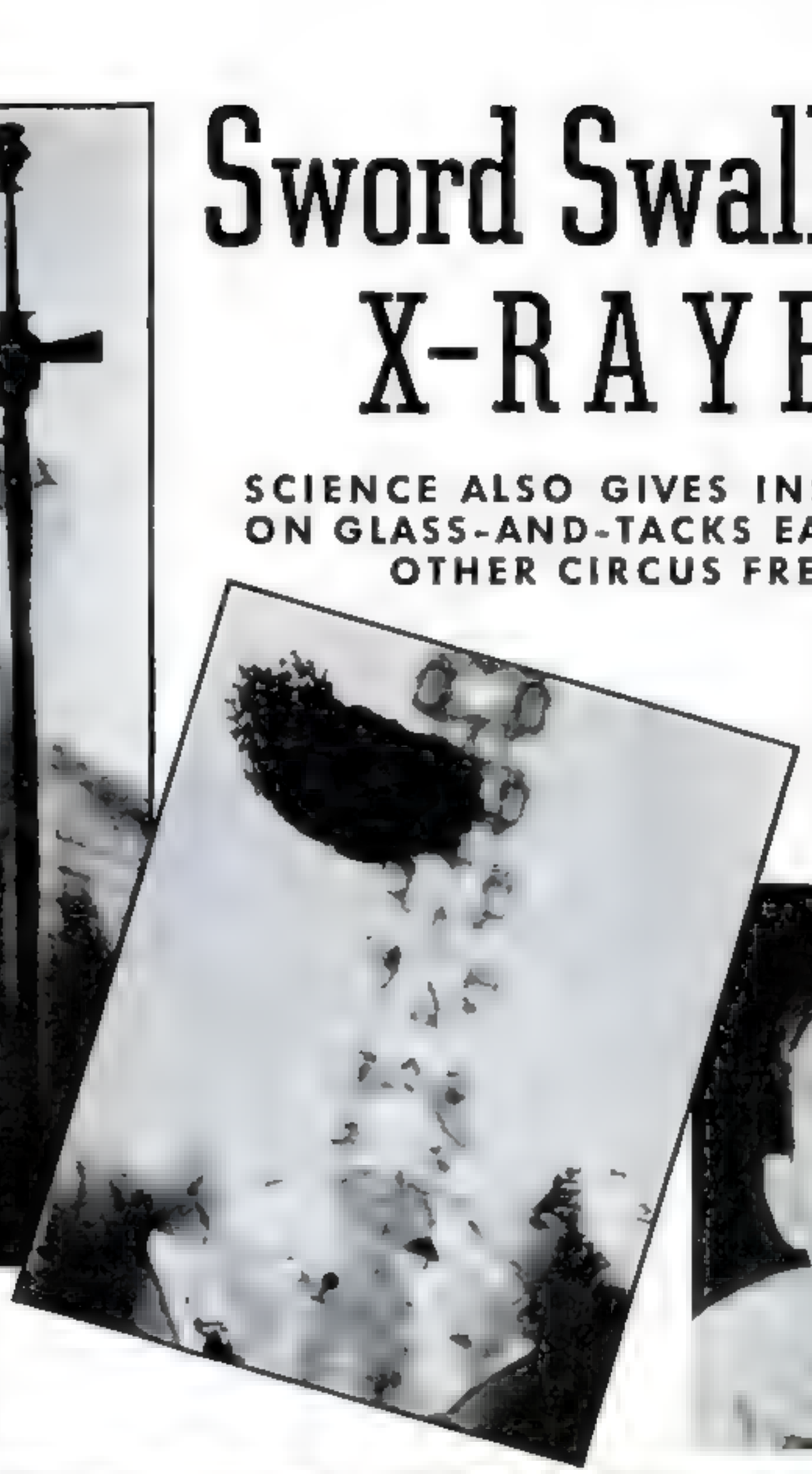
Plow "chiseling" dikes in a field to stop erosion

Sword Swallower X-RAYED

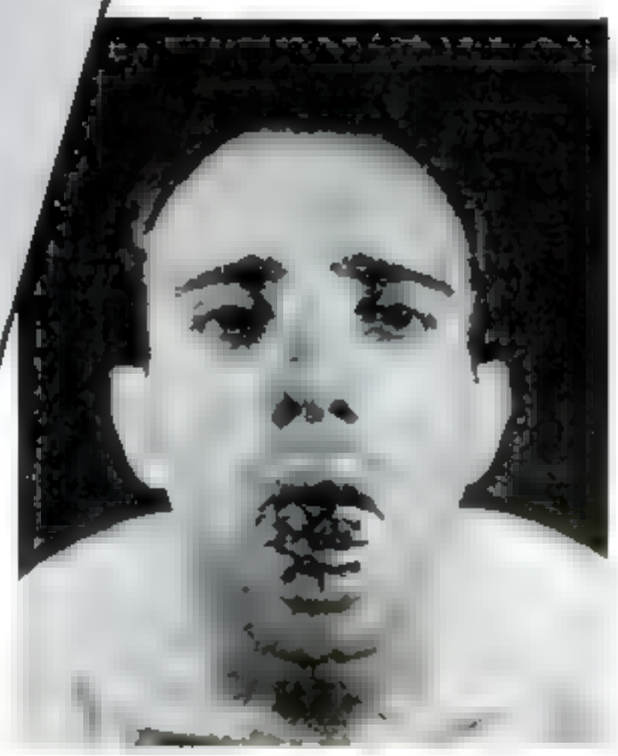
SCIENCE ALSO GIVES INSIDE DOPE ON GLASS-AND-TACKS EATERS AND OTHER CIRCUS FREAKS



Here's your chance to "see through" a performance that astonishes thousands every year. At the left, above, a famous sword swallower is doing his stuff. The X-ray shot alongside is scientific proof that the long blade actually extends down the esophagus into the abdomen



Sebastian Montenero, below, thrives on a diet of tacks, razor blades, and glass. At the left, the X-ray camera discloses a "hair ball," or mass of tacks actually at rest in the performer's stomach



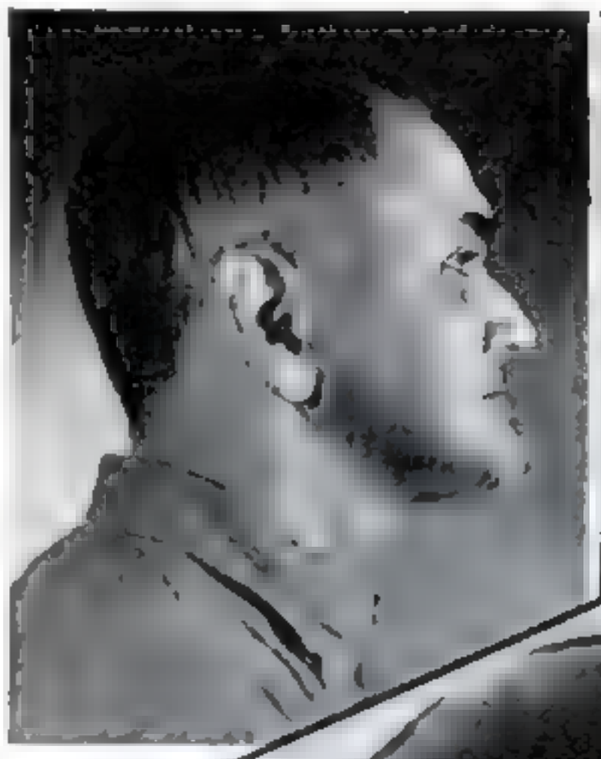
DO SIDE-SHOW sword swallowers really gulp down their long steel blades? Do tack eaters actually swallow their metal meals? Can any man, even a circus freak, twist his head so that he faces directly backwards? Or are these performances merely secret tricks of the circus trade, done with folding swords and other devices?

The answer to these questions is revealed by the pictures on this page showing X-ray photographs made by scientists and proving that the men pictured actually perform the amazing feats claimed for them by circus barkers.

At the top of the page a famous sword swallower is seen with the blade jammed down his throat to the hilt. That this is no illusion is revealed by the adjacent X-ray photograph, which shows the sword blade extending down his esophagus.

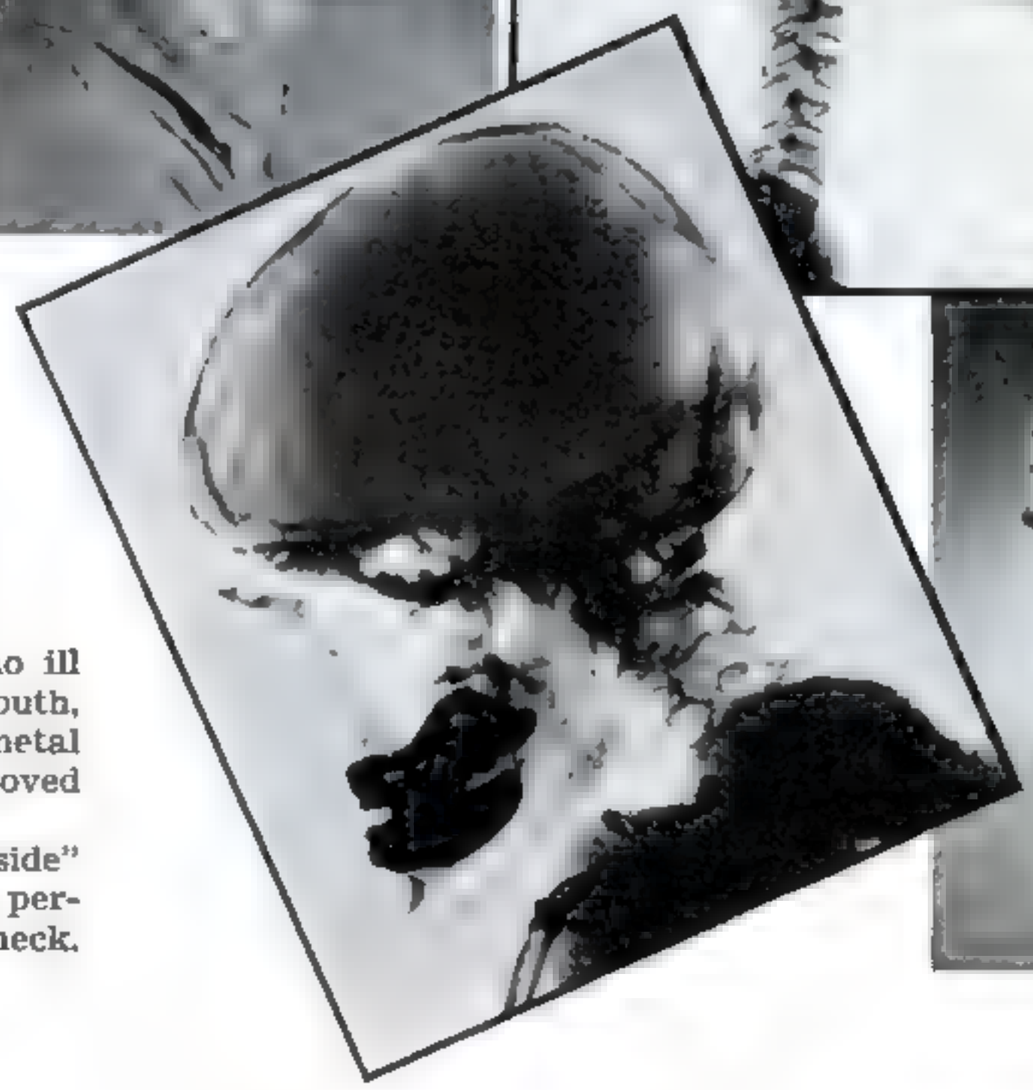
Sebastian Montenero, the tack eater pictured at the upper right, has swallowed thousands of carpet tacks, razor blades, glass, and metal objects with no ill effects. That the tacks seen in his mouth, which he later swallowed, were really metal and not some fake soluble material is proved by the adjoining X-ray shot.

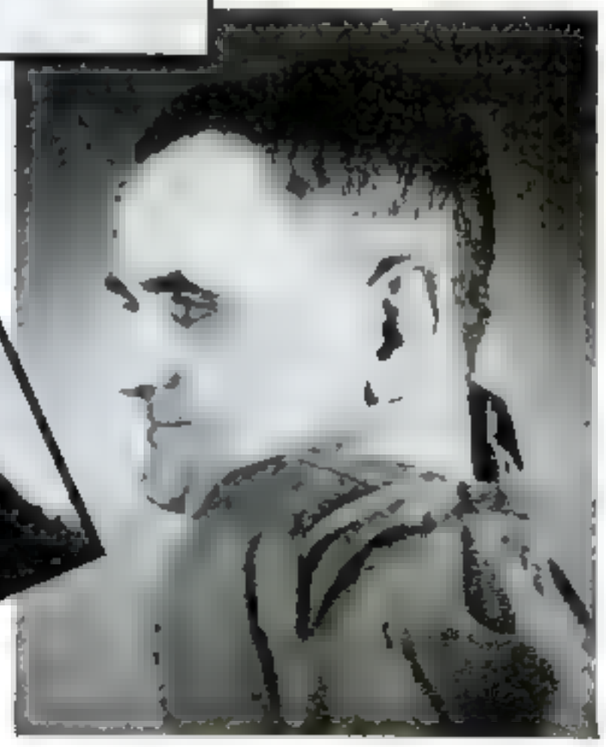
The photographs at the right show "inside" and outside views of the amazing stunt performed by the man with the turntable neck.



There is nothing abnormal in the appearance of the man in the photograph at the far left, but the X-ray picture reveals an unusually long, flexible neck . . .

. . which probably explains how he is able to turn his head 180 degrees on his shoulders as seen in the views below. Unable to breathe in this position, he can hold it half a minute





The Douglas DC-4, largest overland transport plane in America, undergoing load tests that duplicated all the stresses met in normal flight

PLANE FLIES 63,875 MILES IN A SHED

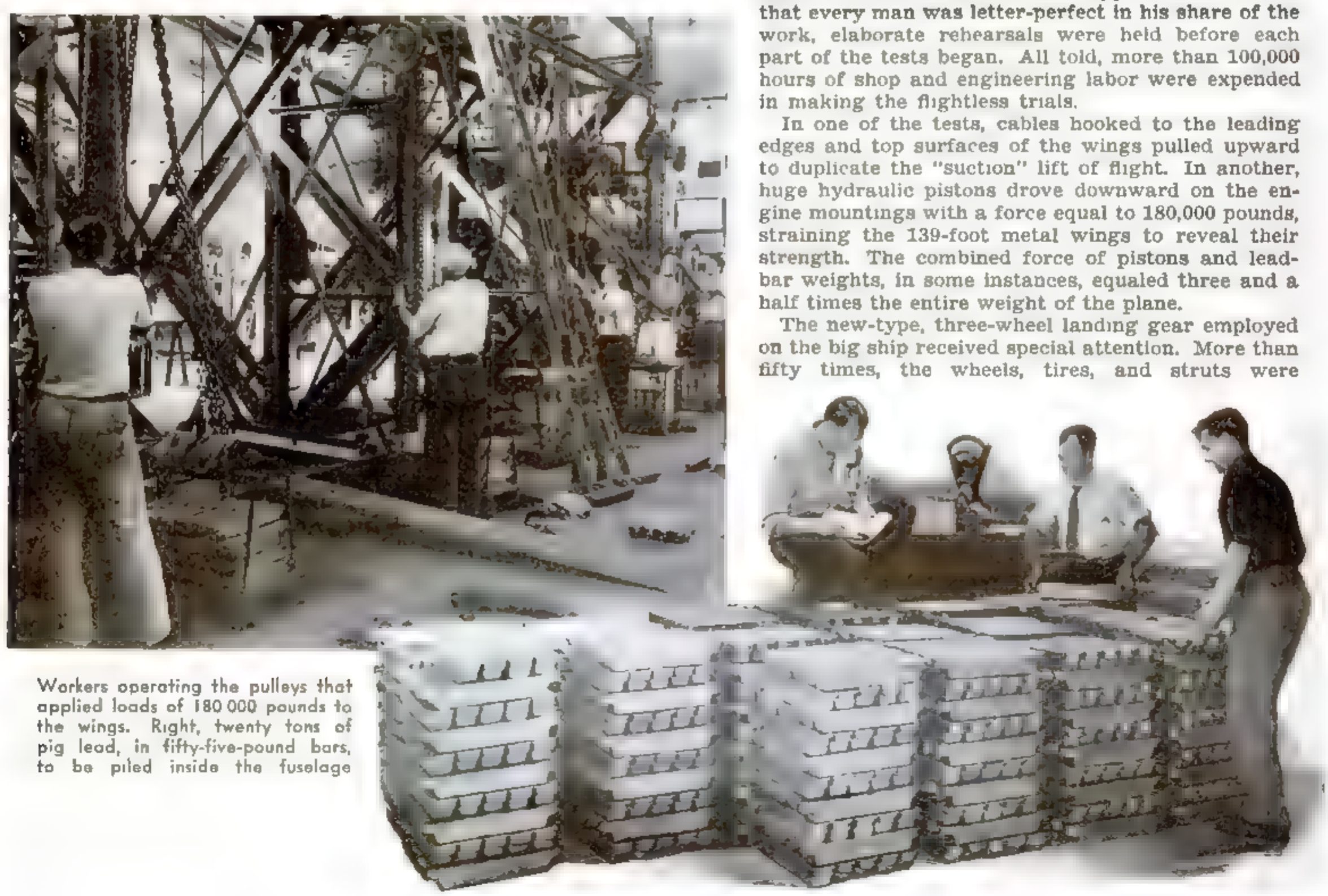
Indoor Test of Mammoth Skyliner Equals Three Trips Around World

WITHOUT leaving its hangar, a new 65,000-pound transcontinental airliner, designed to carry twice as many passengers as present-day transport planes, was subjected recently to all the strains of taking off, zooming, diving, landing, and flying nearly three times around the world. Engineers at the Douglas plant, Santa Monica, Calif., inaugurated the new method of putting costly planes through grueling tests without running the risk of trials in the air. Such "standstill flights" promise to become standard practice in the future.

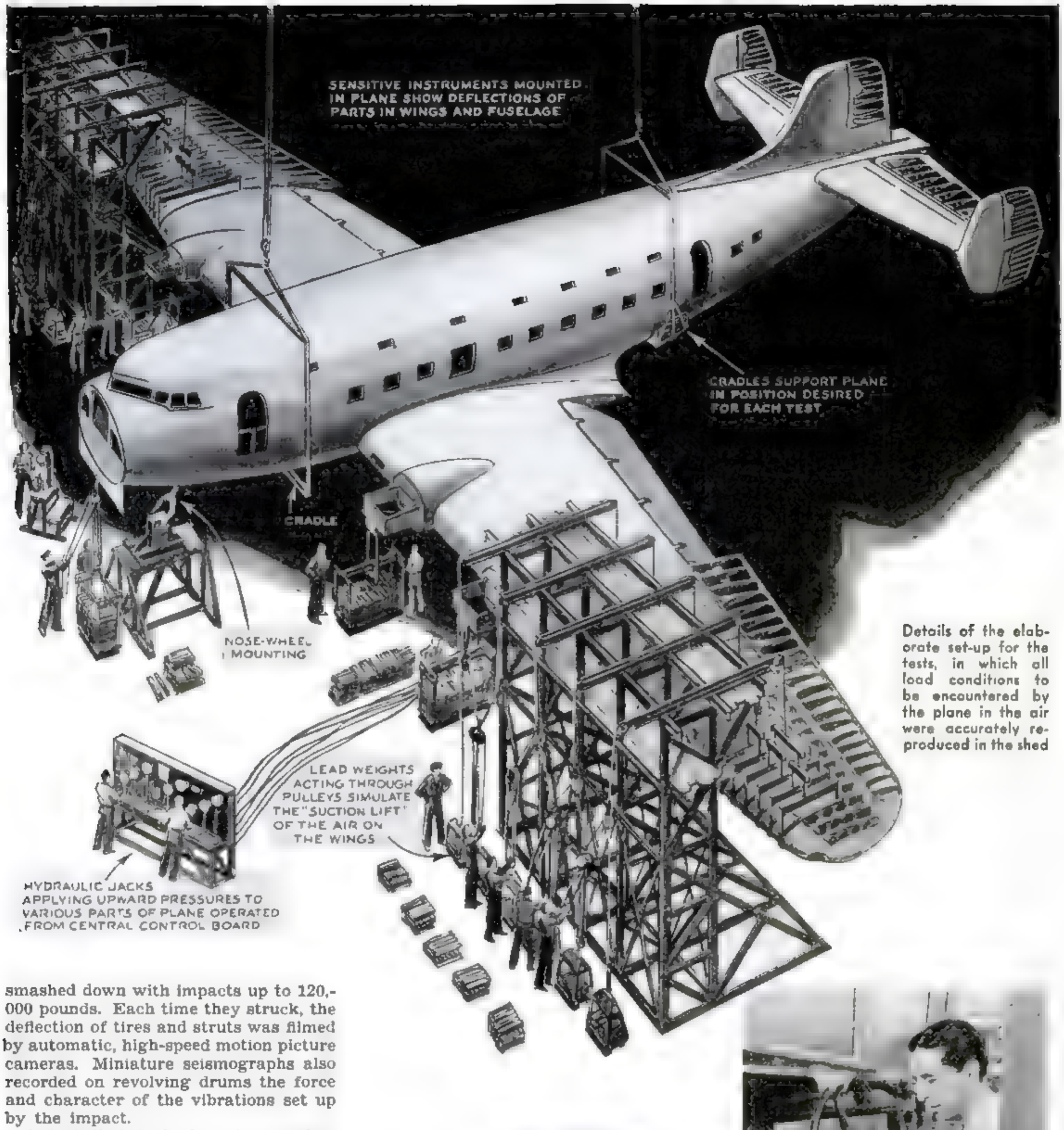
One million pounds of lead, giant hydraulic jacks, block-and-tackle chains, and steel frameworks that looked like parts of a skyscraper skeleton were employed in the tests. As many as 200 sensitive instruments had to be checked and their readings recorded as each successive strain was applied. To be sure that every man was letter-perfect in his share of the work, elaborate rehearsals were held before each part of the tests began. All told, more than 100,000 hours of shop and engineering labor were expended in making the flightless trials.

In one of the tests, cables hooked to the leading edges and top surfaces of the wings pulled upward to duplicate the "suction" lift of flight. In another, huge hydraulic pistons drove downward on the engine mountings with a force equal to 180,000 pounds, straining the 139-foot metal wings to reveal their strength. The combined force of pistons and lead-bar weights, in some instances, equaled three and a half times the entire weight of the plane.

The new-type, three-wheel landing gear employed on the big ship received special attention. More than fifty times, the wheels, tires, and struts were



Workers operating the pulleys that applied loads of 180 000 pounds to the wings. Right, twenty tons of pig lead, in fifty-five-pound bars, to be piled inside the fuselage

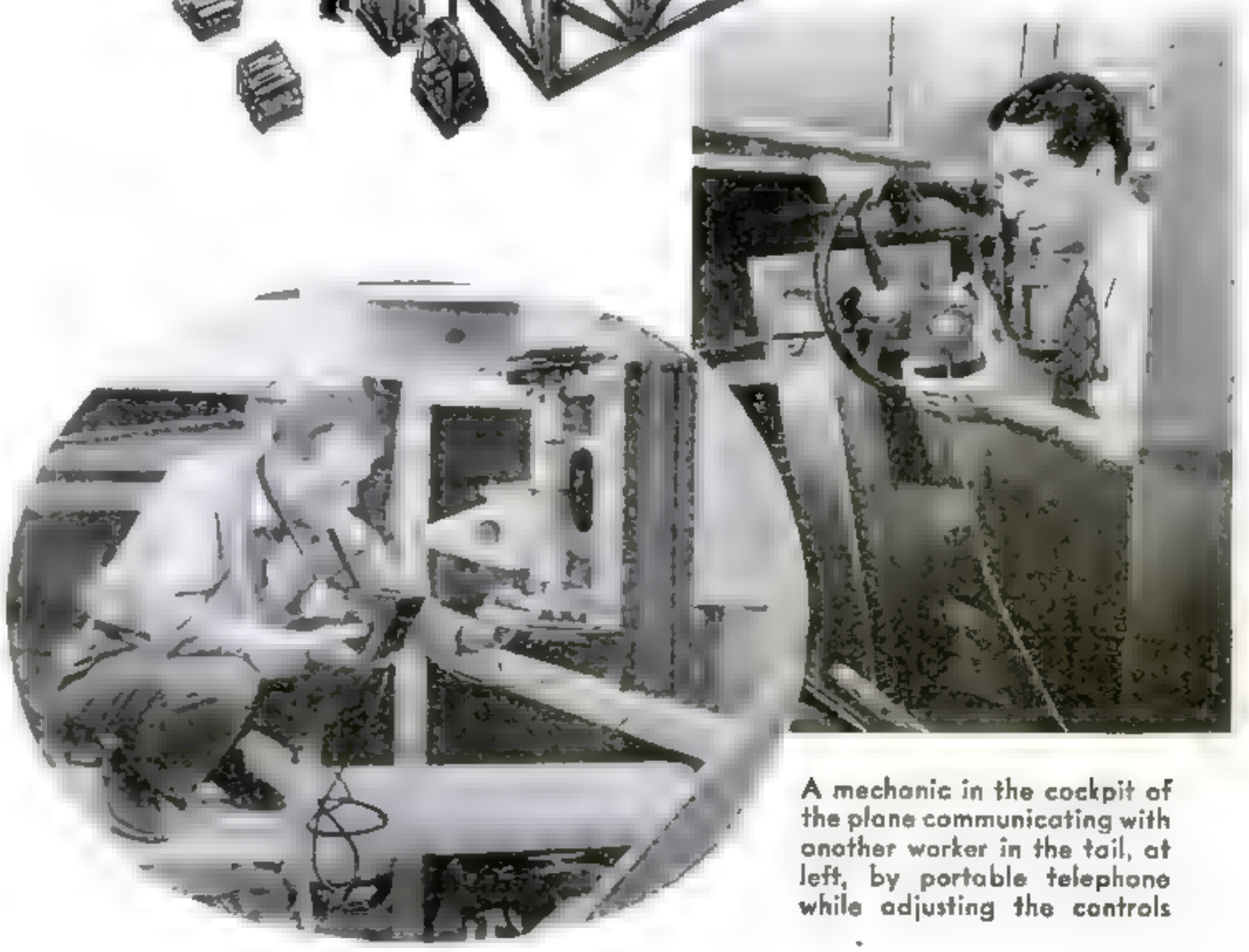


Details of the elaborate set-up for the tests, in which all load conditions to be encountered by the plane in the air were accurately reproduced in the shed

smashed down with impacts up to 120,000 pounds. Each time they struck, the deflection of tires and struts was filmed by automatic, high-speed motion picture cameras. Miniature seismographs also recorded on revolving drums the force and character of the vibrations set up by the impact.

A test that took days to complete reproduced all the strains the plane would undergo if it were pulled up into a 2,000-feet-a-minute zoom while traveling 240 miles an hour. This is the top speed of the forty-two-passenger plane, which was designed at the order of five major air lines. According to the calculations of the engineers, the load-applications and vibration tests piled up a strain equal to that encountered by a plane flying 63,875 miles.

The gigantic size of the new plane is indicated by the fact that when mechanics tackled the job of adjusting the controls, a portable telephone system had to be used for communication between a worker in the cockpit and another at the tail of the ship.



A mechanic in the cockpit of the plane communicating with another worker in the tail, at left, by portable telephone while adjusting the controls

This bow doesn't bend, but strong rubber bands give it power to shoot regulation arrows

Aluminum Bow Uses Rubber Bands

STRONG rubber bands supply the "spring" for a rigid aluminum bow introduced for archery fans. Weighing less than twelve ounces, the new bow is only about half the size of the ordinary wooden type, but is strong enough to shoot regulation arrows. The bow's pulling power is adjustable.

Egg Candler Spots Embryo Chicks

Ordinary egg candler being equipped with colored-glass slides. Right, eggs are viewed through blue glasses

AS AN aid to poultry raisers, Dr. C. W. Knox, of the U. S. Department of Agriculture, has devised a method for distinguishing between fertile and sterile eggs when they have been incubated only from thirteen to twenty hours, making it easy for poultrymen to eliminate eggs that would never hatch. Glass slides, one yellow and one green, are placed before the light of a conventional electric egg candler and the eggs are observed through blue spectacles. Embryos appear as dime-size spots.

Wind-Tunnel Projector Helps Train Pilots

Smoke flowing over a model plane wing is pictured on the screen

AVIATION students in a California school study the action of air on the wing of a plane by means of the laboratory projector pictured at the left. As smoke blows across the surface of a wing model in a miniature wind tunnel, a sectional view is projected by a system of lights and lenses onto a screen where the streams and eddies of air may be easily observed for instruction in airplane design and operation.

With the leg unfolded from its barrel, pencil is a compass

Folding Leg Makes Pencil into Compass

DRAWING compass and mechanical pencil are combined in one unit just placed on the market especially for engineers, draftsmen, and students. The compass leg folds like a jackknife into the barrel of the unit, while the lower end houses the pencil mechanism and the upper end has a durable eraser.

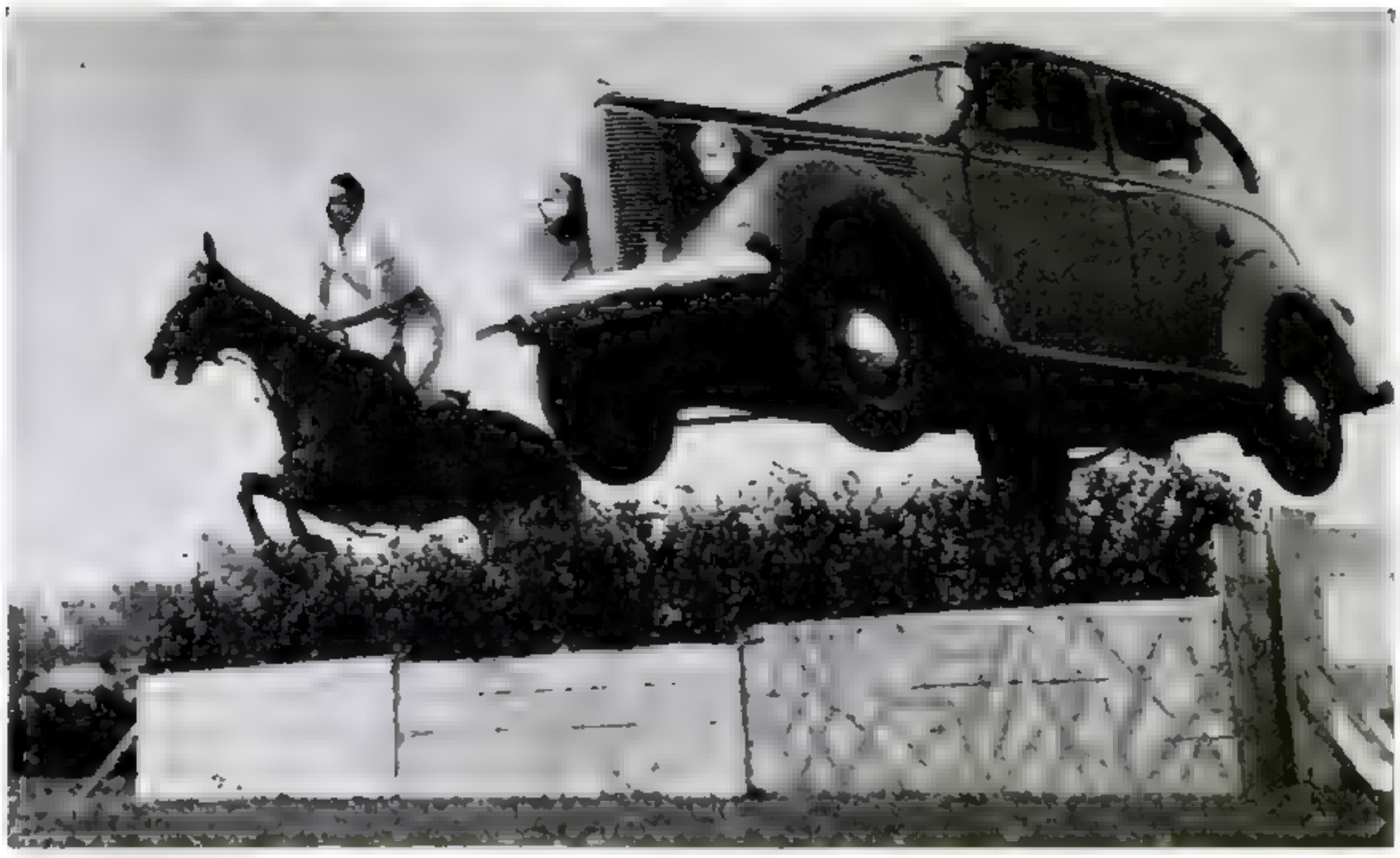
Moving Bonfire Destroys Weeds

TO REMOVE field weeds and trash before summer plowing, Elmo Irwin, Ritzville, Wash., farmer adopted the novel method pictured at the right. Drawn by a tractor, four harrows spanning eighty-five feet collected the trash in their steel teeth. This was then ignited, and additional weeds, gathered as the harrows moved along, caught fire and were destroyed.

Pulled by a tractor, an eighty-five-foot span of harrows drags burning weeds and trash across the field

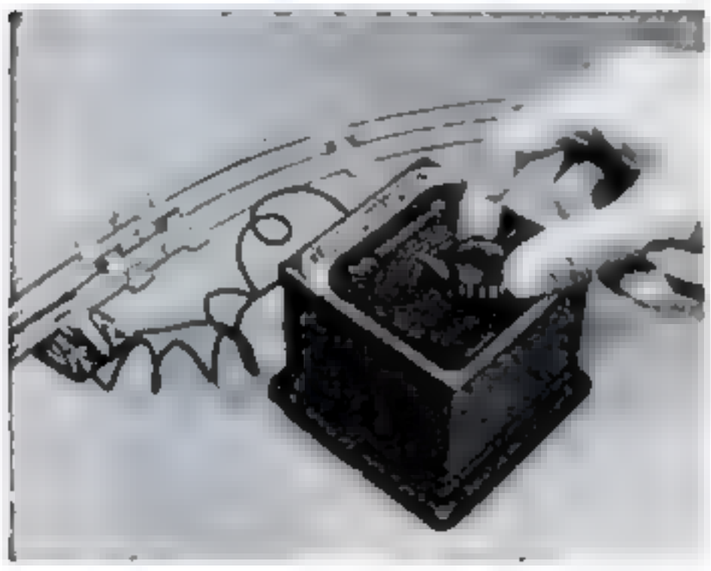
Horse and Car Compete in Hurdle Race

HORSE and automobile were matched recently in a spectacular hurdle race in New Orleans, La. Jimmie Lynch, nationally known stunt driver, piloted a stock-model car down a straight runway and onto a ramp at a mile-a-minute pace. The horse came to the barrier at the same instant, and horse and car soared over together to land on the turf beyond. The photograph reproduced at the right shows the car and the horse side by side in mid-air as they passed over the hedge-topped hurdle.



Talk about mechanized cavalry—here's a stock-model car taking a steeplechase jump with the help of a ramp

Toy-Train Transformer Shows Model's Speed



A TRANSFORMER for toy trains that has just been placed on the market is equipped with a vernier control that permits minute changes in voltage and therefore in the speed of model trains. Compact in size, and fitted with an indicator dial calibrated in "miles an hour," the transformer allows changes in voltage as small as fifteen one-hundredths of a volt.

Novel Eraser Holder

ANCHORED to the side of a typewriter by a rubber suction cup, a novel eraser holder consists of a flexible chain attached to a spring-operated reel. The eraser is pulled out for use, and springs back when released.

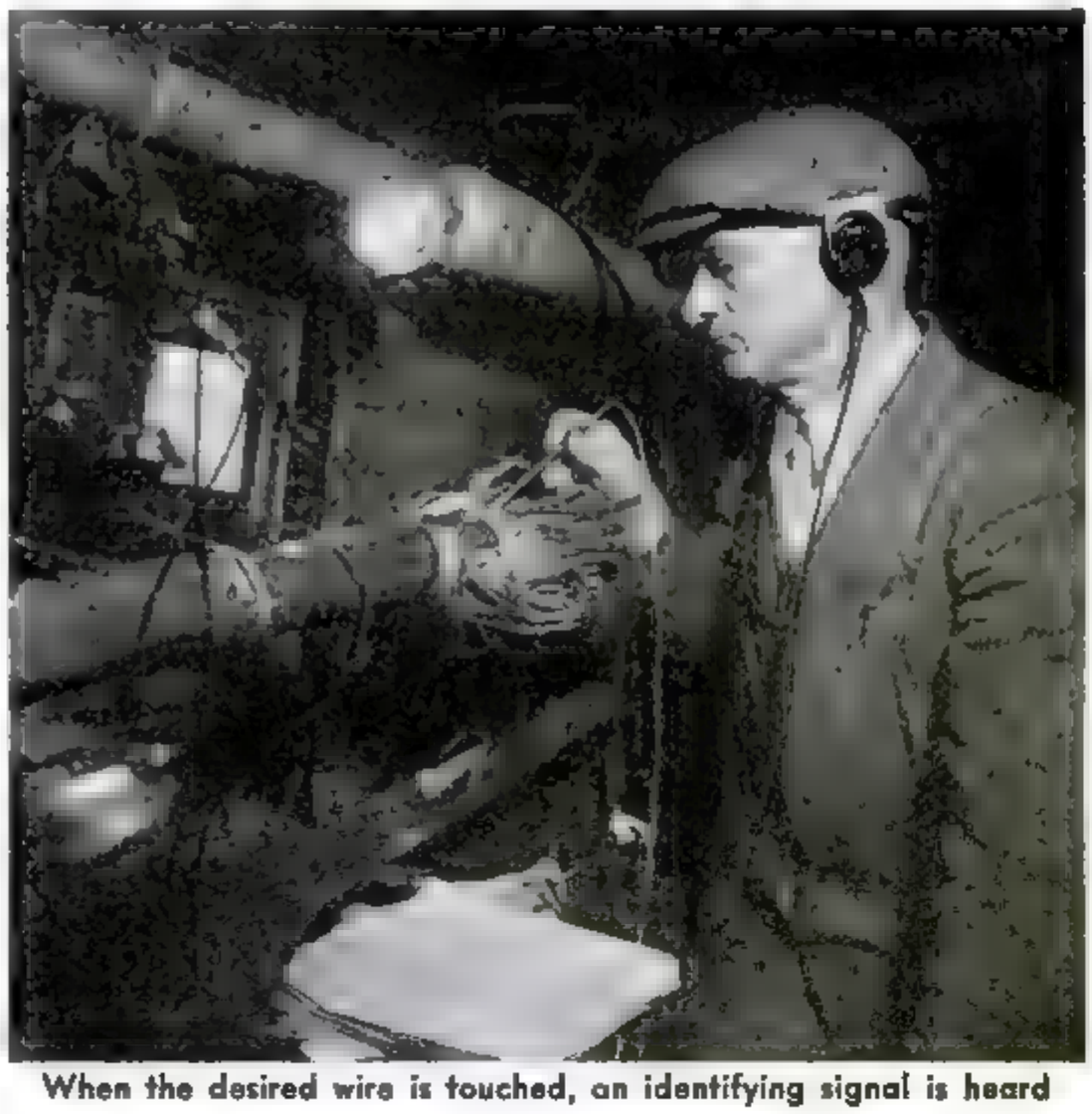
Grooves in tops and bottoms of blocks interlock for stability

Kiddies' Blocks Are Skidproof

CHILDREN'S building blocks of a new type have grooved surfaces on the top and bottom to prevent them from toppling over when in use. Because the grooves on one block fit into those on another, pyramids and other block structures will not collapse easily. The blocks are painted attractively in bright colors with various animal figures and letters of the alphabet.

Detector Identifies Phone-Cable Wires

NICKNAMED a "bliffy sniffer," an exploring amplifier developed by telephone engineers unerringly "sniffs out" a desired line from the maze of wires in a telephone cable. A pencil-shaped instrument, wired to an amplifier and thence to headphones worn by a workman, is passed over the bundle of insulated wires in a cable. When the correct wire is touched, the unit picks up an identifying tone signal that is being sent on that wire from a central telephone office, and reproduces it in the workman's earphones.



When the desired wire is touched, an identifying signal is heard

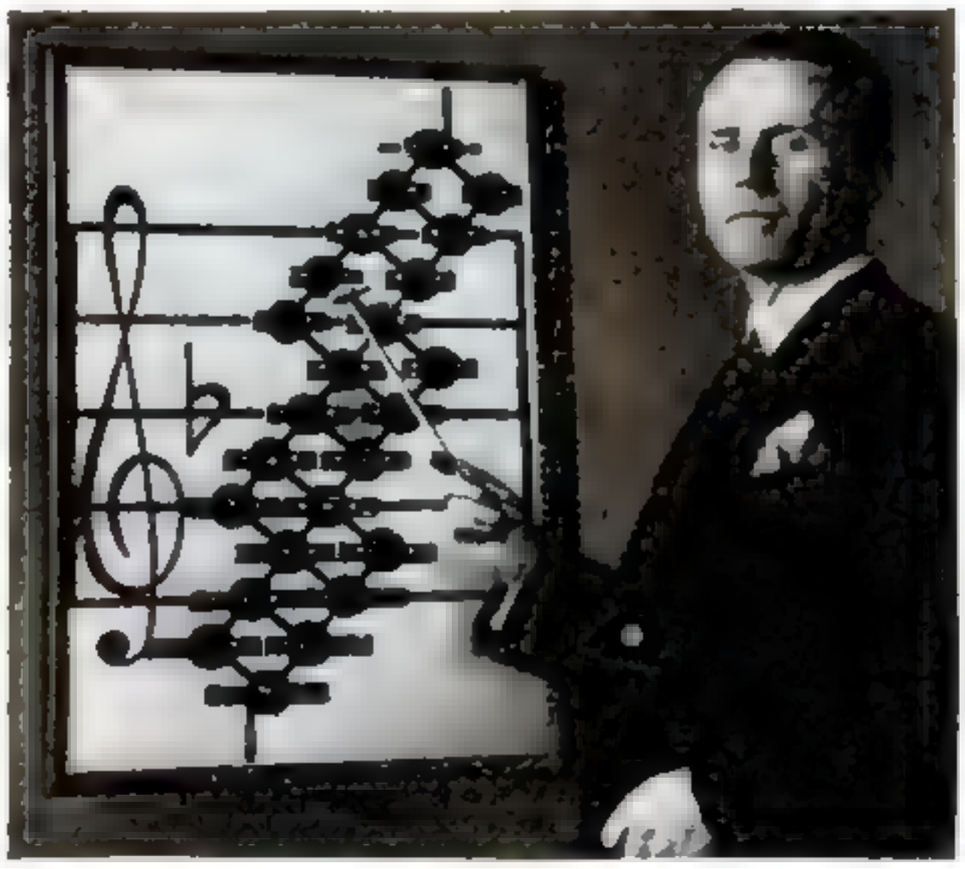
Scientific Worm Farm Keeps Fishermen Supplied

WORM farming is the novel occupation of Mr. and Mrs. Don Wyatt, of Lynwood, Calif. Sold as bait for fishing, the worms are scientifically selected and bred, and raised on specially prepared soil that contains all the elements necessary for healthy growth. At "harvest" time, the worms are picked from the soil and packed in groups of fifty into tin containers. The photograph reproduced below shows the worm farmers at work on a bed of their fish-bait crop, and at the left they are seen packing the worms for shipment.

Mr. and Mrs. Don Wyatt at work on their worm farm. Above, they are packing worms in tins. Right, selecting specimens from the novel harvest

Audible Chart Teaches Music

LEARNING the sequence of notes in the musical scale is made easier by the unusual instrument pictured at the right. Musical metal bars tuned to the right tones are fastened over each note on an enlarged black scale against a white background. When a teacher indicates any note by touching it with a small hammer, the bar sounds the note itself, so that students learn by both seeing the scale and at the same time hearing the tones sounded.

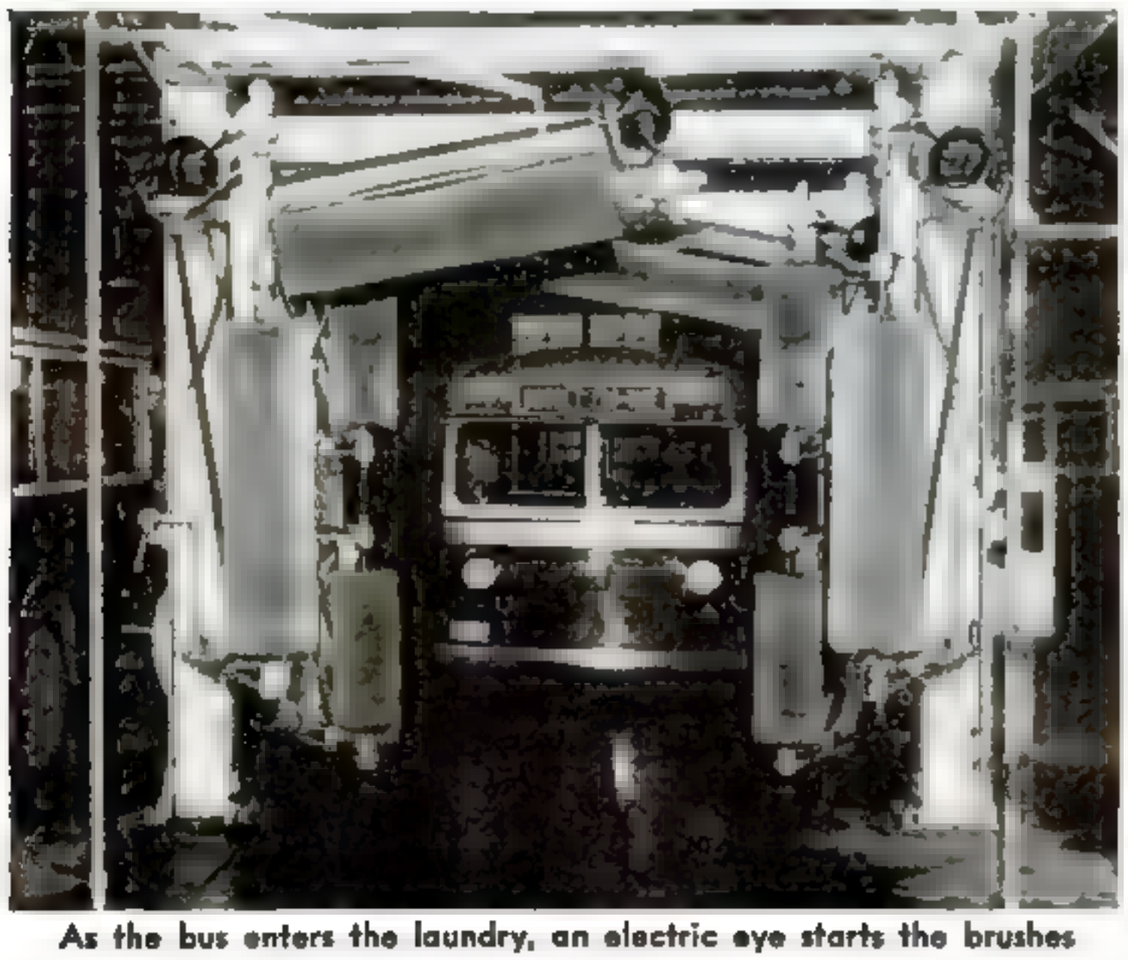


Striking the "notes" on this scale sounds the actual tones

Handy Portable Drill Is Battery-Powered

DESIGNED for work in locations away from power lines, a new half-inch drill operates on either six or twelve-volt current supplied by one or two storage batteries. Unlike most drills, it has no gears, but employs a special motor that is said to produce a sufficient range of speeds for drilling wood or metal and, with a grinding wheel attached, for sharpening tools.

Using the battery-driven drill on a farm machine, far from a regular power source



As the bus enters the laundry, an electric eye starts the brushes

Unit Cleans Busses in 40 Seconds

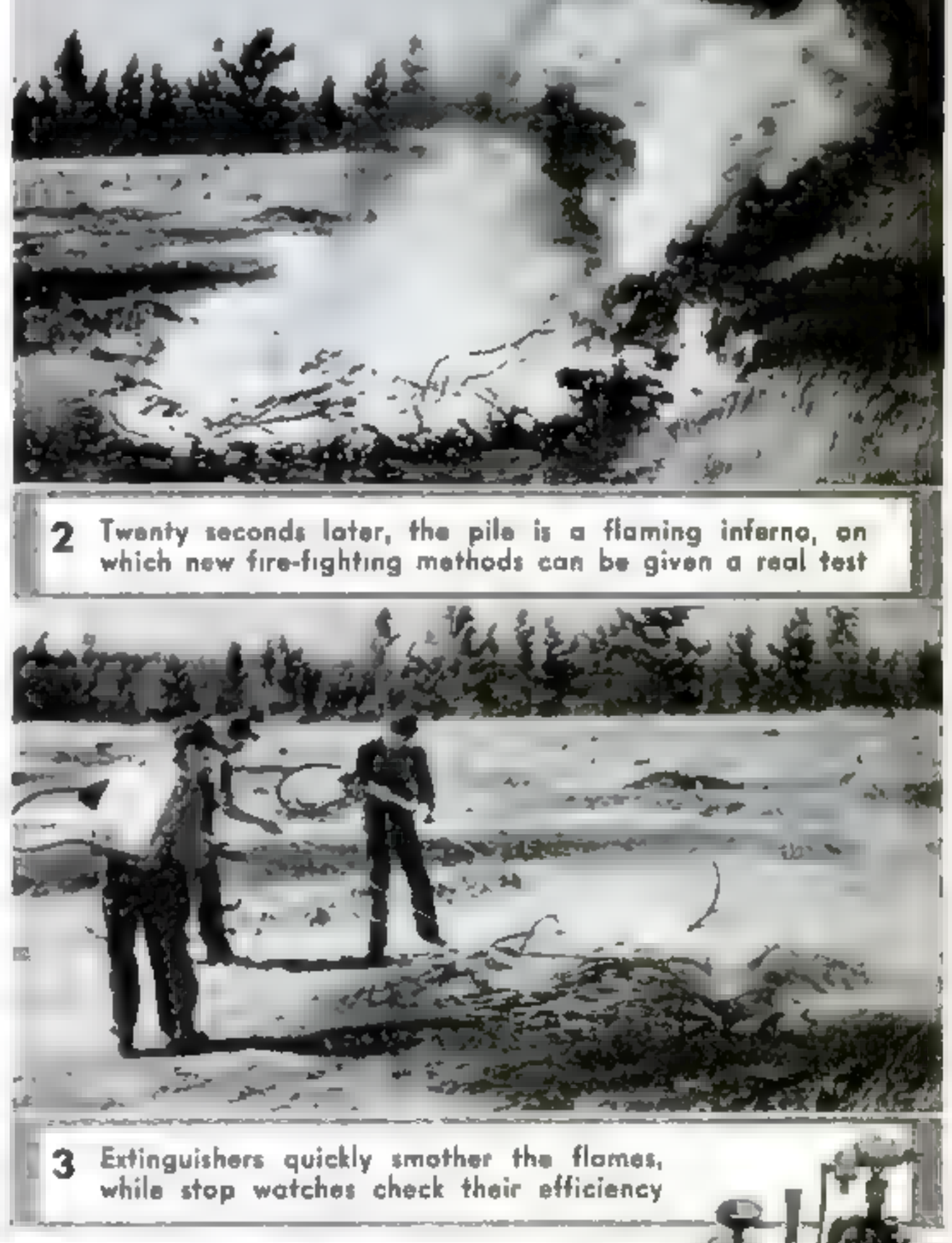
FORTY seconds is all the time required to wash a bus in the novel automatic bus laundry pictured at the left. When the bus driver maneuvers into place and blinks his headlights, a photo-electric cell starts the electrical mechanism, water sprays over the bus, and whirling brushes wash away collected dirt and grime.

TEST-TUBE

Forest Fires

SHOW NEW WAYS TO SAVE TIMBERLANDS

WHAT are the best methods of stemming forest fires that annually destroy $50,000,000 worth of timberlands in the United States? To determine this, scientists of the U. S. Forest Service have been deliberately touching off roaring blazes in the heart of woodlands, making minute observations of the spread of the flames, and then extinguishing the fires with chemical solutions that are the result of intensive research in fire-fighting laboratories. Manned by experts, a special truck is driven to the scene of a test blaze, carrying portable and stationary pumps, cameras, chemical-spray units, shovels, axes, and even a complete set of weather-recording apparatus to permit an accurate estimate of the effects of temperature, humidity, and wind on the spread of a forest fire. When a space has been selected and every precaution taken to confine the area of the test fire, piles of branches, brush, and shrubbery of measured amount and known moisture content are ignited. The spread of the flames is then timed with a stop watch, and the efficiency and speed of extinguishing methods and chemical solutions are noted.



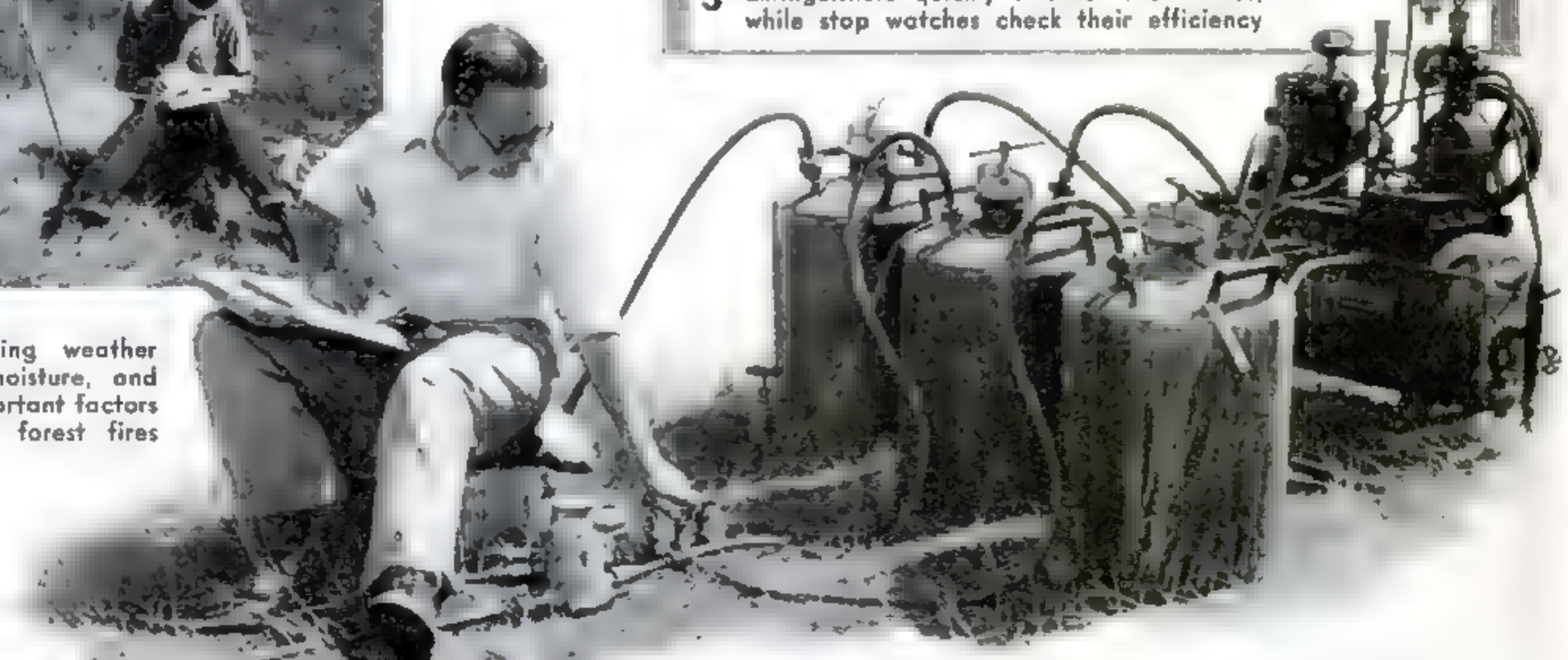
1 U. S. Forest Service workers igniting a pile of branches with a gas torch, to create a forest fire in miniature

2 Twenty seconds later, the pile is a flaming inferno, on which new fire-fighting methods can be given a real test

3 Extinguishers quickly smother the flames, while stop watches check their efficiency

Rolling forest-fire laboratory with its crew. The truck carries the equipment and supplies required for the tests

Crew members noting weather conditions. Wind, moisture, and temperature are important factors in the behavior of forest fires



Experimenter manipulating the valves that control the flow of liquids being applied to a test fire

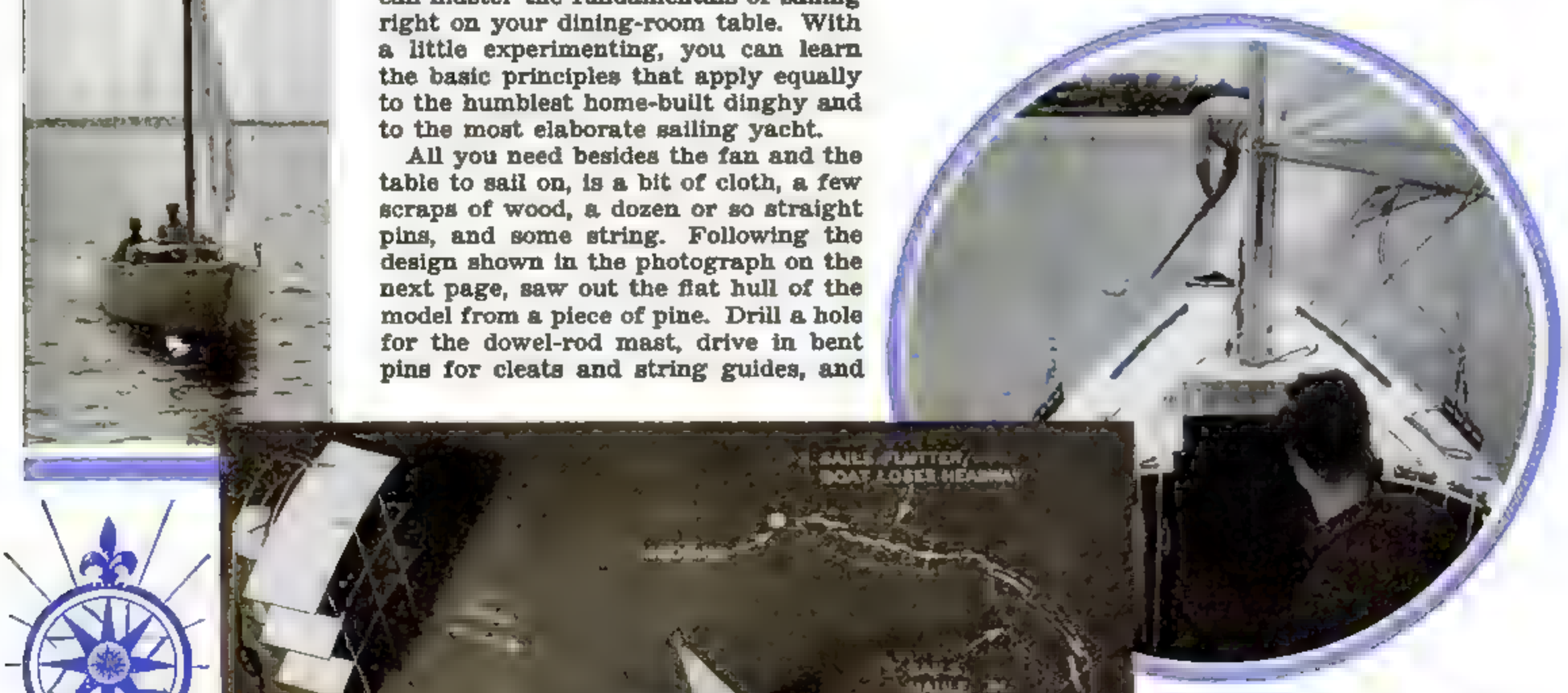
By E. W. MURTFELDT

Learn to Sail ON YOUR DINING TABLE

LUFFING. When the model boat is pointed directly into the wind from the electric fan, the sails flutter aimlessly. In actual sailing, this maneuver is used in approaching a mooring, and in "coming about"

YOU may not know a mainsail from a jib or a centerboard from a halyard. You may never have been any closer to a sailboat than a picture in your Sunday paper. Yet with a tiny model boat that you can put together easily, and an electric fan to whip up a realistic breeze, you can master the fundamentals of sailing right on your dining-room table. With a little experimenting, you can learn the basic principles that apply equally to the humblest home-built dinghy and to the most elaborate sailing yacht.

All you need besides the fan and the table to sail on, is a bit of cloth, a few scraps of wood, a dozen or so straight pins, and some string. Following the design shown in the photograph on the next page, saw out the flat hull of the model from a piece of pine. Drill a hole for the dowel-rod mast, drive in bent pins for cleats and string guides, and cut out the sails from an old handkerchief or shirt tail. After you have hoisted the sails on strings, tie the bottom of the larger sail (mainsail) to a boom which pivots on the lower end of the mast. Finally, attach your sheets or sail-control lines, two for the small front sail called the jib and another for the mainsail. When this is done, you are ready to cast off and head out into the electric-fan wind.



PICKING UP A MOORING. The job of "parking" a sailboat puzzles landsmen. The diagram at left shows how the craft is maneuvered into the wind to slow it down so the buoy can be reached with a boat hook

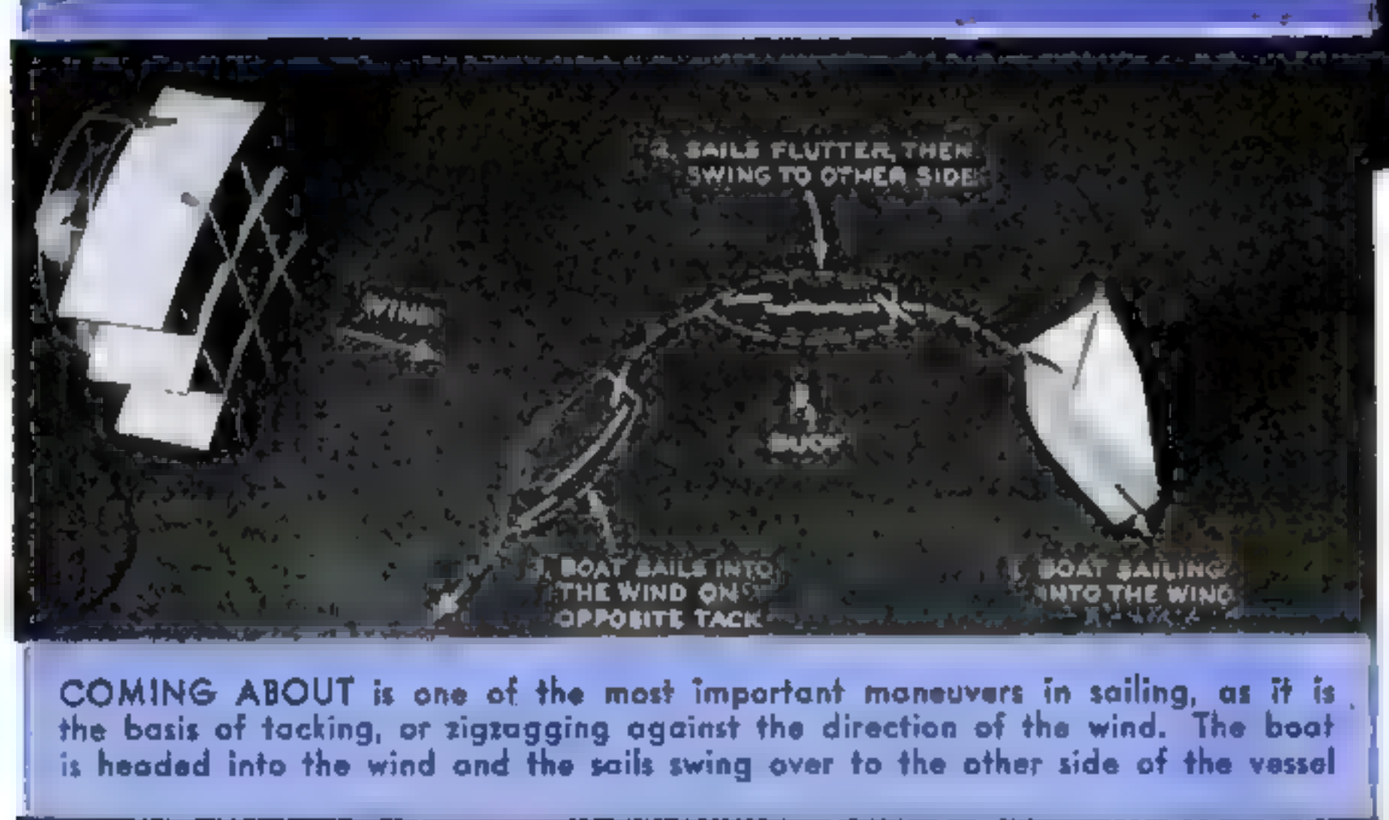
A Simple Homemade Model and an Electric Fan Illustrate the Fundamentals of Yachting

To produce a breeze more nearly like that encountered on the open water, tie or tape a cardboard separator, of the kind used in packing eggs, to the wire guard in front of the fan. This will break up the eddies and cross currents which are created by the whirling blades.

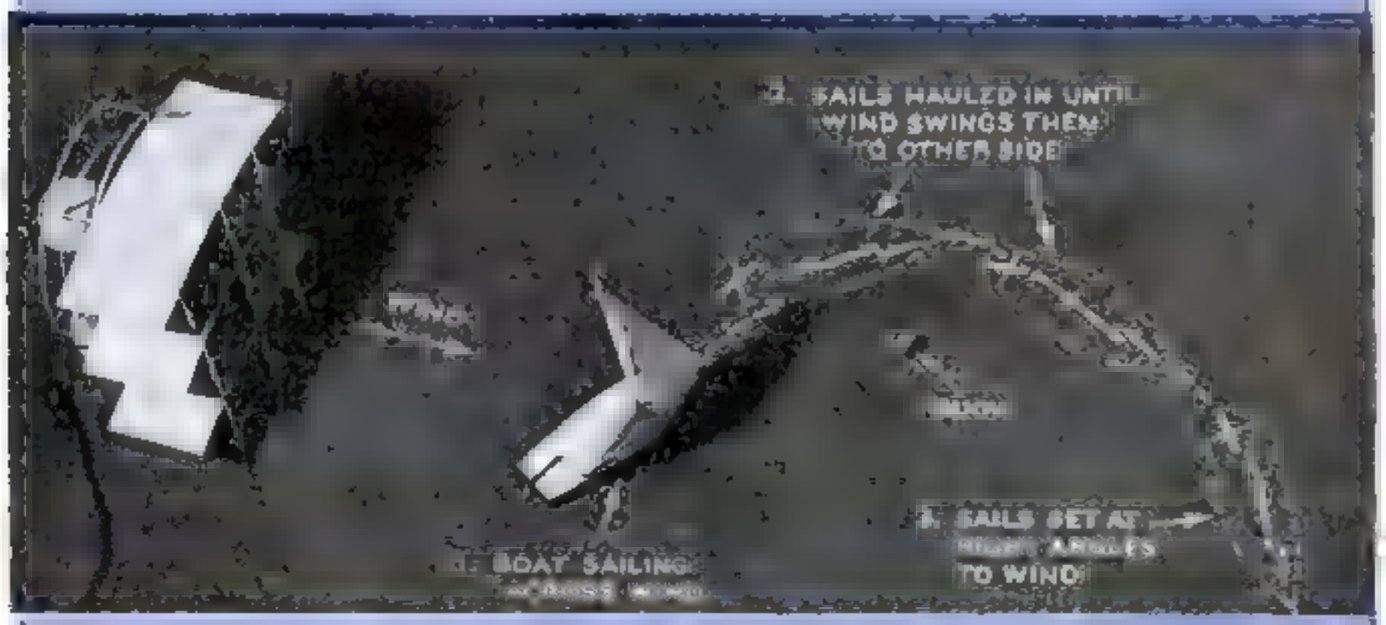
In its simplest form, sailing is being pushed through the water by a wind blowing against a sail from the rear. The resistance of the sail to the wind is greater than that of the boat to the water and the craft moves forward. Modern boats, however, can sail at an angle to the wind, and by zigzagging, or tacking, can even work their way against the wind. How they do this is always a mystery to the layman. The explanation lies in the fact that the keel and hull of the boat offer strong resistance to sidewise movement, while the sharp-pointed prow cuts through the water easily.

As you slide your model boat out into the air stream on your table-top ocean, study the action of the breeze on the sails. Naturally, the model won't give you the feel of a real boat sliding through the water under a spread of canvas, but by pointing the bow in various directions in relation to the electric-fan wind, and studying the movement of the sails and the pull on the lines that control them, you can pick up a good deal of valuable information about the three primary ways of sailing—with the wind, called running; across the wind, called reaching; and into the wind, called beating or pointing.

To see how a boat runs before the wind, turn your model so that the bow points away from the fan, letting the mainsail swing out until it rides practically at right angles to the center



COMING ABOUT is one of the most important maneuvers in sailing, as it is the basis of tacking, or zigzagging against the direction of the wind. The boat is headed into the wind and the sails swing over to the other side of the vessel



JIBING resembles coming about, except that it is done with the wind astern. If controlled, it is a safe sailing trick, but an accidental jibe can be very dangerous as the boom may be whipped across so violently as to do considerable damage

REACHING. For sailing sidewise to the wind, the boat is turned in the desired direction and the sails are let out until they begin to flutter. Then they are hauled in to catch the breeze

Here's the craft you use in your table-top yachting, with names of its rigging. You can put it together in a couple of hours with a few pieces of wood, a dozen or so of pins, strings, and some scraps of cloth

line of the boat. Loosen the strings holding the jib so that this sail can also belly out and fill with wind. This is the oldest method of sailing, and the only one known in ancient times. On the Nile, thousands of years ago, Egyptians needed only to sail with the wind, for the northward flow of the current would carry their ships down to the river mouth, where the early square-type sails could be hoisted to let the prevailing northerly wind blow the boats back upstream.

Now turn the model sidewise to the wind. Let the sails out until they flutter, then haul them in so that they catch the breeze. This is the position of a boat and its sails when she is reaching, or sailing across the wind. But if a real boat had a flat bottom like your model, the wind would drive the boat sidewise instead of forward. All sailboats, therefore, have a keel, centerboard, or leeboards that project down into the water below the boat's hull to resist and check this lateral movement.

CLOSE-HAULED. How a sailboat can steer close into the wind is always a mystery to laymen. Sails are hauled in nearly parallel to the center line. The model is being held atilt to represent the "heel" or slant of a real boat

Point the bow of your table-top craft toward but not directly at the fan, tighten down the sheets (lines) that control the angle of your sails, and the model will be in the position of a sailboat moving toward the wind. This is what sailors call beating to windward, or sailing close-hauled—that is, with the sails hauled in almost parallel to the center line of the boat.

In this position, your model will not heel, or tip sidewise from the force of the wind, but a real sailboat in a stiff breeze will sometimes dip its side right into the water as it races along. If this angle of heel becomes dangerous, the boat can be straightened up either by steering more into the wind, or by letting out the sails so that they ride at less of an angle to the wind.

The average sailboat will not move unless it is pointed at an angle of about forty-five degrees or more off the wind. You can easily tell if your model is pointed too close into the wind for efficient sailing by watching the sails. When the leading edges, or luffs, start to flutter, wind is getting in back of the sails and you must turn the bow of the boat a little farther away from the wind until this flapping stops.

Now swing your dining-table boat slowly into the wind until it is facing directly at the fan and you will see the sails catch the wind from both sides and flutter aimlessly. This is called luffing, and is used to stop a sailboat when approaching a dock or mooring, and in "coming about."

When your model boat is pointing at an angle into the wind in a close-hauled position, turn it slowly toward the fan until it luffs, and then continue turning it until it points away from the wind on the opposite side of the fan. The sails will first flutter as the boat points directly into the wind, and then will swing over to the other side of the boat, as you continue turning it, and finally fill up again with wind. Called coming about, this maneuver is used in tacking, or following a zigzag course to sail a boat to a point that lies directly in the teeth of the wind.

Coming about is also the safe way of changing direction when running before the wind, but a boat can shift its sails from one side to the other when the wind is blowing from astern, or behind, instead of from ahead. To demonstrate this, place the model in the position of running before the wind, with the mainsail boom out practically at right angles to the boat. Now turn the boat slowly so that the tip of the boom moves toward the fan and watch the sail. When the breeze catches the back of the sail, it will whip the boom around to the other side of the craft.

Called a jibe, this maneuver can be extremely dangerous if it happens accidentally, as the lunging boom of a sailboat may crash into passengers, rip away the rigging, snap the mast, and even capsize the boat itself.

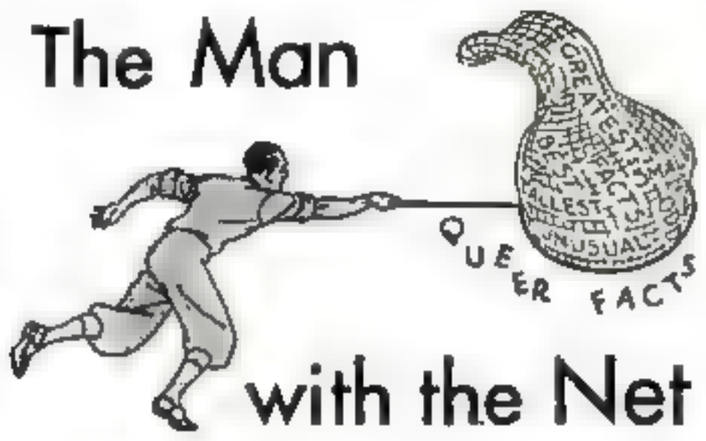
RUNNING, or sailing before the wind, is simplest of all. Sails are about at right angles to the center line

Controlled jibing, however, is a legitimate sailing maneuver and can be accomplished with safety, as you can determine by trying it on your model. Place the boat once more in the position of running before the wind, but this time as you turn it toward the boom, haul in the mainsail gradually until it is almost parallel with the boat before the wind has a chance to catch the back of the sail. When this finally occurs, the sail will move only a short distance and will not have a chance to gain speed and momentum before its swing is checked.

Jibing, it has probably occurred to you, is just the reverse of coming about. In coming about, the boat shifts from one tack or direction to another when the wind is ahead, and in jibing, when it is astern. Watch your model when you place it in the position of running before

(Continued on page 92)

The Man with the Net



ELECTRIC *washing machines exercise trout at one American hatchery.*

CORNFIELDS *are eroded 100 times as fast as pastures.*

CALIFORNIA *Indians used chewing gum long before the coming of the white men.*

REAR TIRES, *on automobiles driven over hard-surface roads, wear out twice as fast as front tires.*

BLACKSNAKES *can climb as high as thirty feet into trees.*

DRY FLIES *for fishing were used by the Romans as early as 200 A.D.*

ONE MILLION *pounds of silver each year go into the manufacture of photographic films.*

SHARK OIL *is being used to lubricate Japanese airplane engines.*

EVERYBODY *in the world could be supplied with one full-length garment of artificial silk out of the present annual production of rayon.*

HOUSE FLIES *on the wing can attain a speed of more than six feet a second.*

ONE THIRD *of all present-day factory products were unknown in 1880.*

HEATED NAILS, *driven in the wall, are less likely to crack the plaster than cold nails.*

SYNTHETIC MOONLIGHT *has been developed by a New York lighting engineer.*

Pollen Census Aids Hay-Fever Sufferers

Glycerin-coated slide being put in tube to catch pollen samples

Technician examining slides to count and identify pollen

A CENSUS of air-borne pollens that cause hay fever is now being made every day in New York City. Clean glass slides coated with a glycerin jelly are placed in metal tubes and exposed to the air at various points throughout the city. Each evening, the slides are collected and sent to a laboratory, where microscopic examination is made to determine the types and quantity of pollen present in the atmosphere. Results are made available to doctors, hospitals, and newspapers.

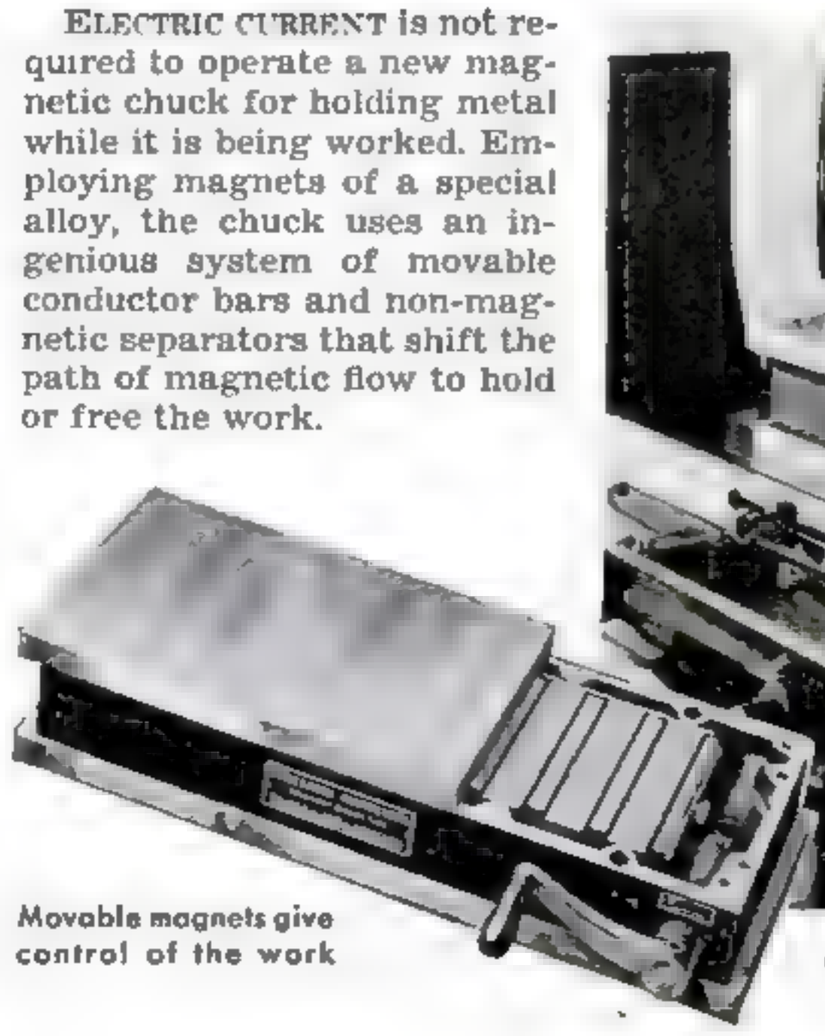
Letter Opener Doubles as a Postage Scale

LETTER OPENER and postage scale are combined in a new desk accessory just marketed. To determine whether a letter weighs more than one ounce, the blade is pulled forward to a spring stop in the handle and the device laid on a flat surface. When the letter is placed on the handle the blade will tilt upward if more than minimum postage is required.

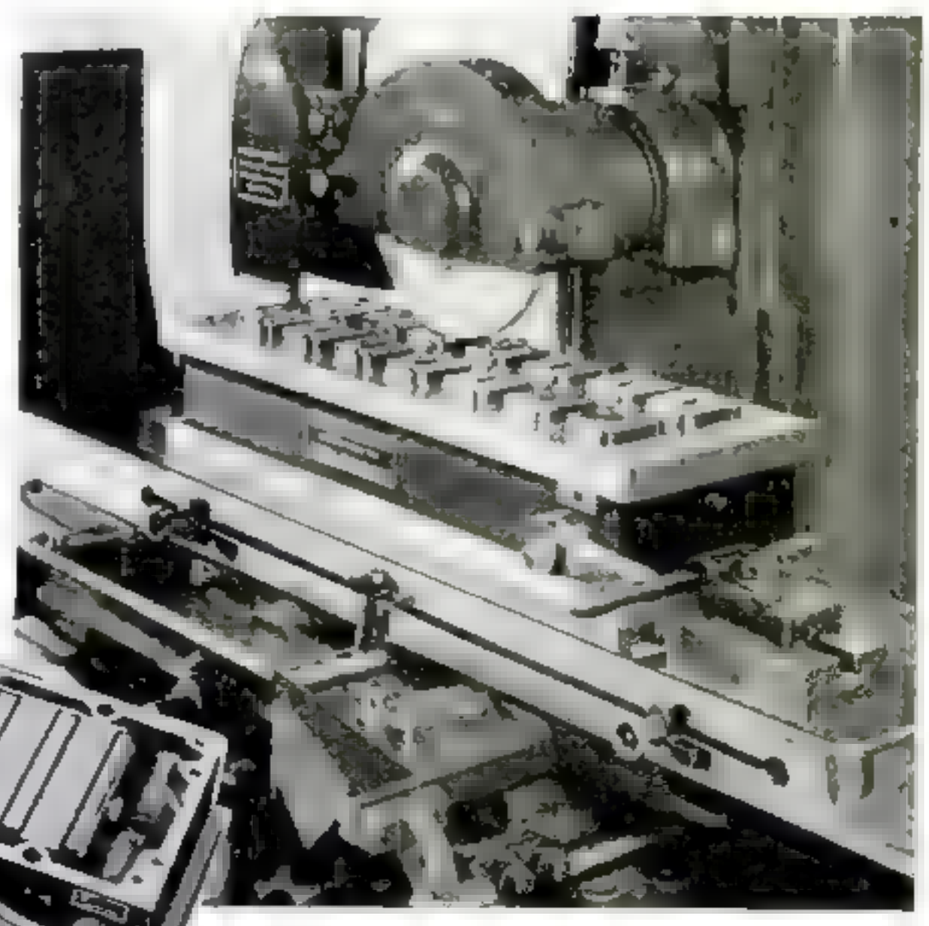
The blade tips up if the letter needs more than minimum postage

Permanent Magnets Hold Metal for Working

ELECTRIC CURRENT is not required to operate a new magnetic chuck for holding metal while it is being worked. Employing magnets of a special alloy, the chuck uses an ingenious system of movable conductor bars and non-magnetic separators that shift the path of magnetic flow to hold or free the work.



Movable magnets give control of the work



Metal parts on magnetic chuck for grinding

Tests Show Way To Reduce Plane Fires

USING a giant wind tunnel as a blower, U. S. Bureau of Air Commerce engineers have tried out a method for emergency dumping of gasoline from the tanks of an airplane in flight, that is said to minimize the fire hazard. Through experiments like that pictured below, experts found that if fuel is dumped so that it does not touch fuselage or tail surfaces, any fires that may start will be snuffed out by the air blast from the propeller.

This test indicated that, in a strong blast of wind, burning gasoline will not set fire to an airplane wing

Lens and Mirror Locate Cinders

MAGNIFYING glass and mirror are combined in a new accessory said to be useful for locating cinders or other foreign particles lodged in the eye. When the magnifying lens is held over the mirror, examination of the eye can easily be made, as shown in the photograph above.

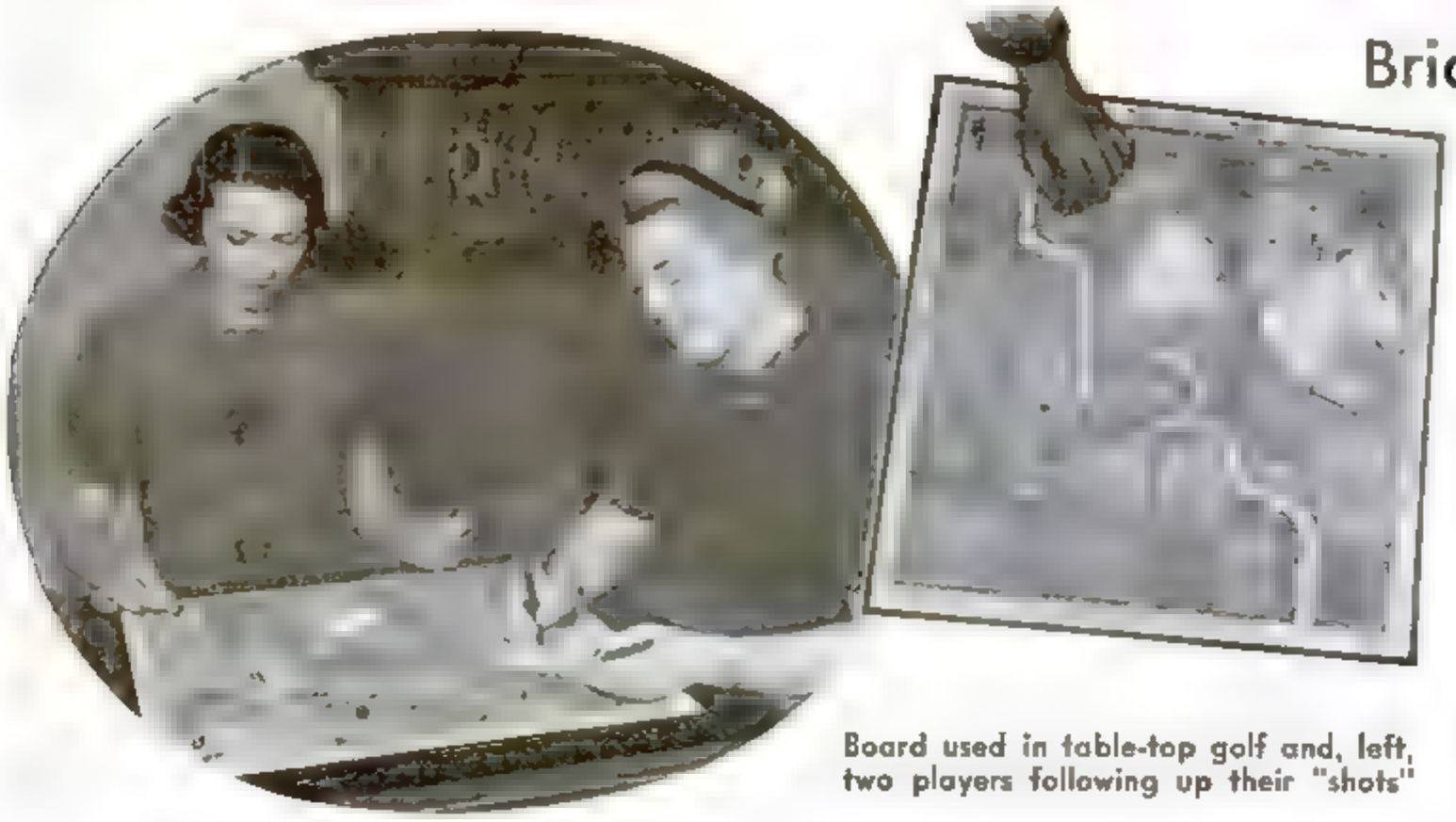
Treadmill Walks the Dog

A TREADMILL exerciser, shown above, enables dogs to walk or run while remaining in one spot. It is designed for use by dogs kept in city apartments.

Device Tries Color Combinations for Cars

TO VISUALIZE the effect of various color combinations for automobile and truck bodies, one Detroit factory uses a novel color-mixing machine. Disks of the colors to be used are placed together to form sectors of a circle, and the composite disk is rotated rapidly. When the blended color effect is satisfactory, the relative amounts of the two colors making up the disk are noted, and the colors are applied in the same proportions in working out the decorative scheme for the car-painting job.

Colored disks being placed in the rotating machine for mixing



Board used in table-top golf and, left, two players following up their "shots"

Bridge-Table Golf Game Played with Cards

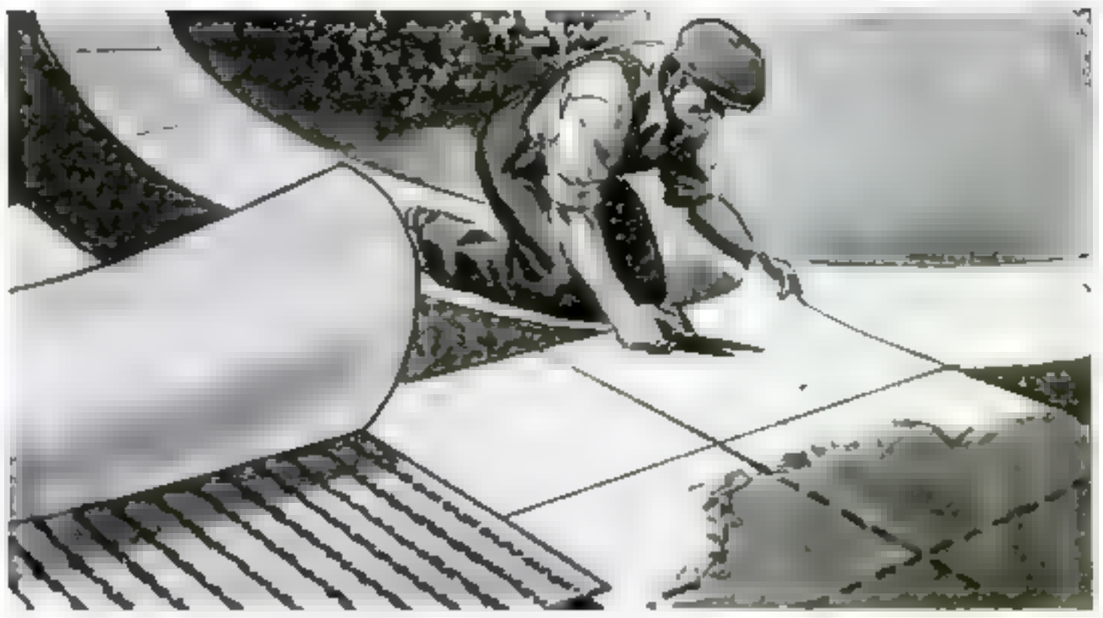
PLAYED on a board that represents a nine-hole golf course, a novel parlor game just introduced offers many of the features of the real sport. The presence of traps, bunkers, and water hazards, and the selection of the proper club all play a part in the success of contestants. Tiny balls in different colors are used as markers to follow the movements of the game as designated by cards drawn from a specially designed pack. In the course of the game, players can make clean, straight "shots" down the fairways, or fall into difficulties through slices and hooks into bunkers and other hazards.

Helps for Lawn and Garden

No need to kneel with this garden "horse"

Rocking Seat Makes Weeding Easy

TIPPING like a hobbyhorse, a novel garden seat makes it easy to weed vegetable or flower beds without stooping or kneeling on the ground. Made of metal, the garden horse has a hollow neck through which weeds may be dropped into a refuse container after they have been pulled up, for later disposal. A bar set across the opening serves as a handle for carrying the lightweight seat from place to place.

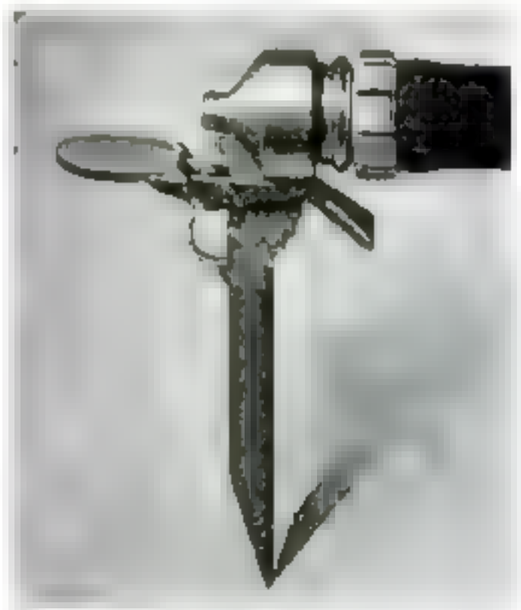


"Tailored" Lawns Laid Like Linoleum

LAWNS can be laid like linoleum and tailored to fit around walks, drives, and buildings by the use of a material consisting of grass seed sandwiched between sheets of special vegetable paper. Cut to shape and laid on the ground, the paper is moistened and covered with topsoil. Soon the paper disintegrates and grass springs up, resulting in a more evenly sown lawn than could be produced by hand scattering of seed.

Nozzle Serves as Sprinkler

NOZZLE and sprinkler are combined in one unit in a garden-hose accessory now available. Threaded to fit any standard hose coupling, the device has a built-in metal stake which can be stuck into the ground to hold the sprinkler in position. An adjustable plate in front of the nozzle stream creates four different types of sprays.



Nozzle with spike and spray plate

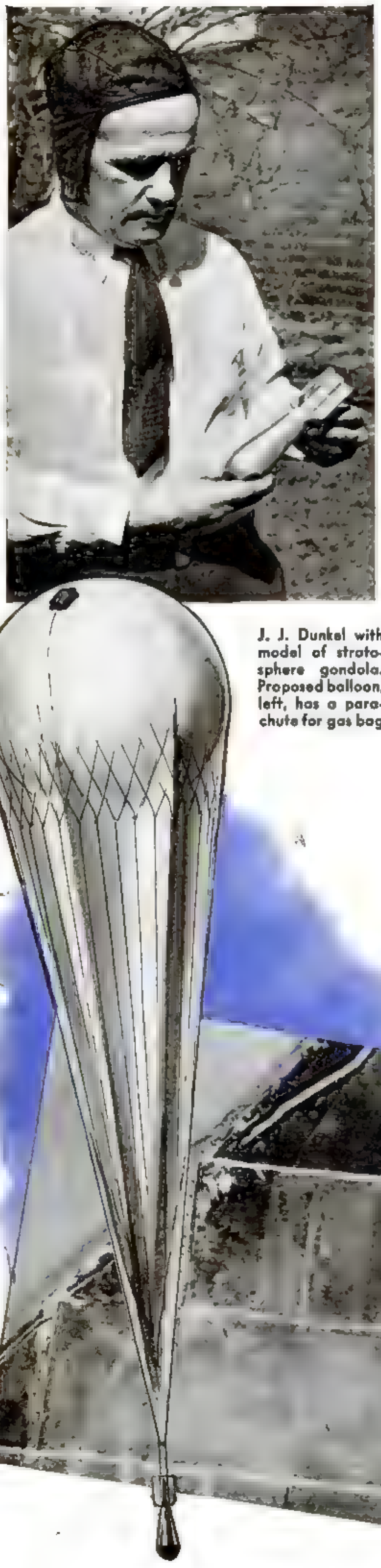
Porous Canvas Hose Saturates Soil

A HOSE of porous canvas laid along the ground is a new method of applying water to lawns, gardens, and hedges. Water seeps through the hose, as demonstrated above, supplying moisture to the ground evenly and without waste. The open end connects to a regular garden hose in place of the nozzle.

Spray Kills Fungus and Dyes Grass

BROWN PATCH, a fungous disease that causes unsightly brown spots on lawns, is controlled by a new chemical spray that also colors the patch to the shade of the surrounding grass. With a green dye as a base, the chemical is mixed to match any hue.

Colored chemical spray being applied to grass to kill fungus and restore the natural tint to the lawn



J. J. Dunkel with model of stratosphere gondola. Proposed balloon, left, has a parachute for gas bag

TWENTY-ONE-MILE

Veteran Stunt Balloonist Plans

By WALTER E. BURTON

ONE OF the most daring and fantastic stunts ever attempted—a twenty-one-mile parachute leap—is now being planned by a Cleveland, Ohio, dare-devil. Using a bomb-shaped gondola and stratosphere balloon of his own design, he hopes to rise to the top of the sky. At 110,000 feet, he will cut the balloon free and plummet toward the earth in his streamline metal cabin, speeding downward for more than 80,000 feet before releasing a parachute built into the gondola's tail.

The airman who plans this thrilling journey is no amateur sky rider. He is no crackpot, unaware of the dangers and difficulties in the way. He is Joseph J. Dunkel—the man who has made more parachute jumps than any other person in the world.

At the age of forty-one, this veteran has piled up a record of nearly 1,300 jumps. His longest drop was 28,800 feet; his shortest 250 feet. Once, he bailed out at 18,000 feet and plunged 16,500 before he jerked the rip cord. Another time, he hit the air going 300 miles an hour, leaving a plane in the middle of a power dive.

When he goes into the stratosphere, he will have two goals in sight. During the ascent, he will try to reach the greatest height ever attained by man. And, during the descent, he will seek to reach the greatest speed ever experienced by a human. To achieve these goals, Dunkel has been working on the plans of a radically new type of stratosphere craft.

The bag of the balloon has been designed so it will be impossible for the neck to freeze shut and cause the balloon to burst in the frigid, rarefied air at the peak of its ascent. Another innovation is said to prevent dilution of the hydrogen gas. Lifted by this great gas container, Dunkel expects to penetrate the upper reaches of the sky to a height of nearly twenty-one miles. The present altitude record for stratosphere balloons is approximately fourteen miles.

This long ascent, however, will be only the preliminary to the real drama of the trip. High above the earth, Dunkel will jerk a cord, cutting loose the gondola and at the same time ripping open the gas bag, which will de-

Below, what a 'chute jumper sees: a landing field with circle marked as a target

Dunkel owns fifty-six kinds of parachutes. Here he is using a triangular 'chute which can be steered

PARACHUTE LEAP

Daring Jump from the Stratosphere

flate itself and float to earth supported by a parachute. In the meantime, the streamline gondola will plummet downward like an arrow, held on its course by fins at the rear. It will be traveling, Dunkel calculates, 2,000 miles an hour before it reaches denser atmosphere.

To withstand tremendous strains, the man-carrying meteor is to have a framework of steel tubing covered with sheets of superstrong alloy. An inner chamber of aluminum, an upright cylinder slung on special shock absorbers to eliminate unnecessary jars, will hold the standing passenger and scientific instruments. Should Dunkel lose consciousness and slump down in the cylinder, during the terrific plunge to earth, the act will automatically release the parachute at the tail of the gondola. This thirty-two-foot 'chute is designed to land the metal car at a speed of less than twenty miles an hour.

If all goes well, Dunkel plans to cut loose from the balloon at 110,000 feet, then wait until he is 30,000 feet above the earth before releasing the tail parachute. At 5,000 feet he will open a trapdoor in the nose of the gondola and drop out to descend, by means of a small pack parachute, to the ground.

The cost of constructing the stratosphere craft and of making the flight would be in the neighborhood of $100,000, he estimates. However, he believes, the scientific data on stresses and strains at meteoric speeds, which the flight would show, would be of incalculable value in designing high-flying speed planes of the future.

If Dunkel succeeds in making this spectacular ride to earth, it will climax a career of danger and daring which began when he was less than fourteen years old.

For, literally, Dunkel has been on the jump all his life. As a youngster, he was fascinated by the hot-air balloon exhibitions at Cleveland amusement parks. His heroes were the aëronauts who rode these frail craft aloft to cut loose *(Continued on page 99)*

Drawings at right and below show details of the plan for a leap from the stratosphere

For nearly thirty years, Dunkel has thrilled crowds by his daring jumps at fairs and other gatherings

Factory workers lined up outside the X-ray truck to be examined for diseases of lungs

Rolling Laboratory X-Rays Workers

CALLED the first of its kind, a cruising laboratory just placed in service by New York State health authorities can roll up to any factory or quarry, plug a 150-foot electric cable into the nearest outlet, and X-ray workers for traces of lung disease at the rate of one every two minutes. It will be used in a survey to determine what industrial processes expose workers to the greatest risk of silicosis and other diseases caused by inhaling dust.

A subject standing before the X-ray camera. The test takes two minutes

Sidewalk Signal Boxes Halt Trolley Cars

TO SAVE pedestrians from dodging speeding automobiles to board street cars, ninety-eight sidewalk signals are being installed in Detroit, Mich. When a prospective rider presses a button, as shown above, a lamp signals the motorman to stop, and the passenger need not leave the curb until traffic has also halted.

Auxiliary Vise Jaws Grip Fragile Parts

AUXILIARY jaws of new design, instantly attached to any vise, firmly hold odd-shaped or fragile parts without marring or distortion. The set includes hinged jaws for beveled parts, fabric-padded jaws for flat pieces of nickel, brass, and wood, and slotted jaws for round and square rods.

Weighted adapters hold the special jaws in place on any vise. Inset shows three of the four styles included in the complete set

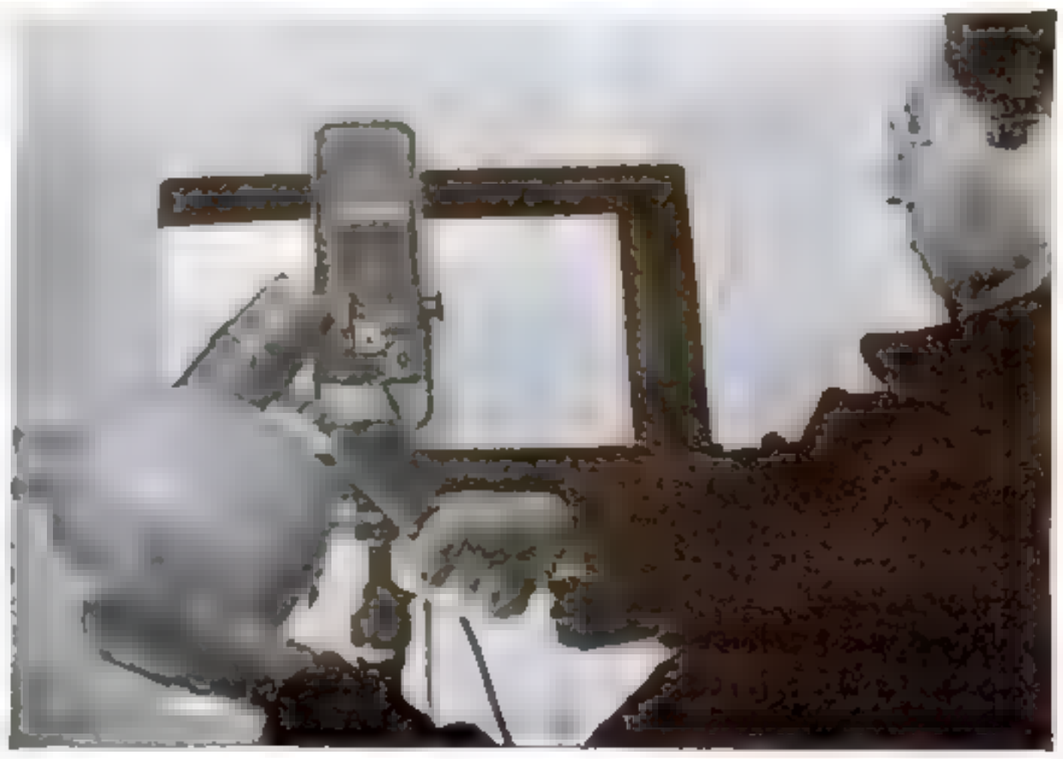
Whistle Is Made of Chewing Gum

YEARS ago, toy whistles were often made of candy. To keep in line with the modern trend, manufacturers now mold similar noisemakers out of chewing gum. After a child has tired of using it as a whistle, he can chew it like a stick of ordinary chewing gum as there are no metal or wooden parts.

When you get tired of blowing these new whistles, you can chew them up

Melons Make Noises for Radio Dramas

STUNTS with a melon now provide realistic sound effects for radio gangster dramas. Hitting one with a mallet imitates the thud of a revolver butt upon a victim's skull, and dropping it from the top of a ladder to the floor sounds in the loudspeakers like the impact of a falling human body.



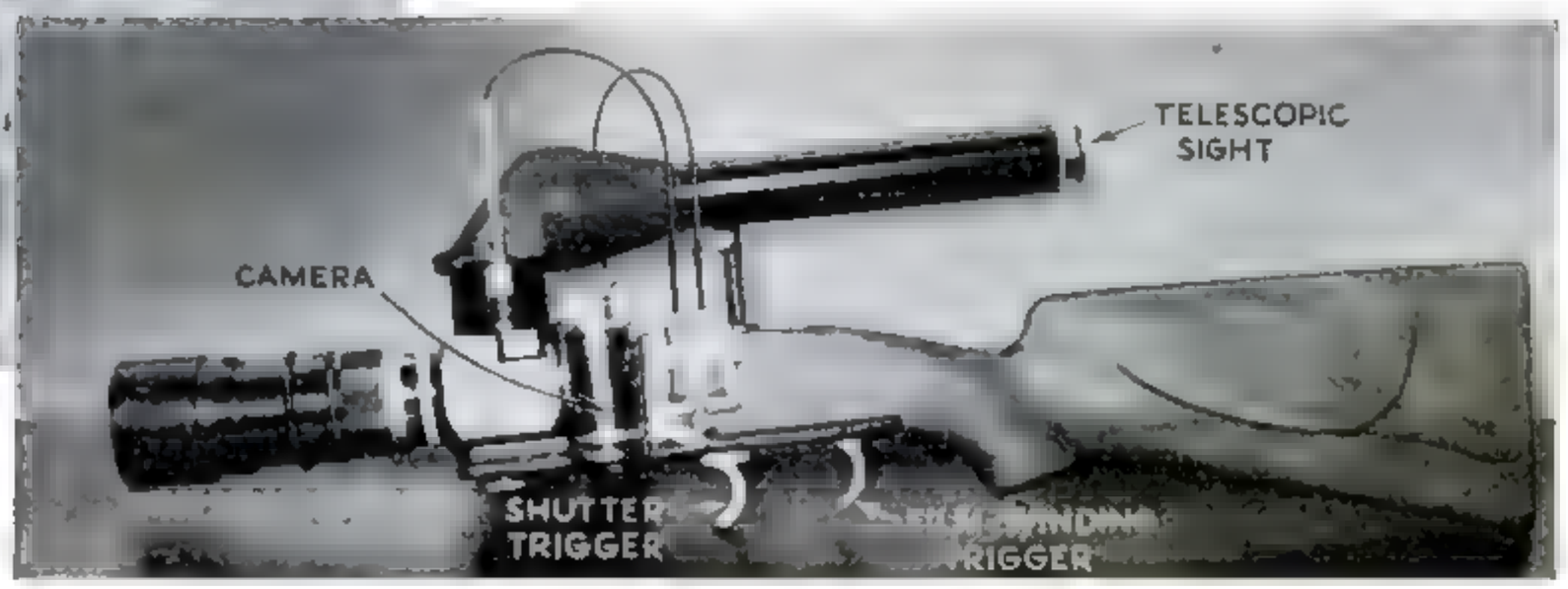
Hitting a melon with a mallet represents a blow from a gun butt

Newest Aids for Camera Users

The camera gun in use. It is focused by moving the lens with the left hand while the image is viewed through a telescopic sight. Illustration at right shows arrangement of the parts

Camera Gun Gets Long Shots

A TWIN-TRIGGER camera gun is now available for use in the field by explorers, naturalists, and sportsmen. It consists of a miniature camera equipped with a telephoto lens and mounted on a rifle stock. Focusing is done by moving the lens back and forth while watching the image on a ground-glass screen through a telescopic sight. The forward trigger on the gun snaps the shutter and takes the picture, and the rear one sets the shutter and winds the film ahead. Photographs can be taken with the outfit as fast as the triggers can be pulled. By loosening two knurled knobs, the camera can be removed for reloading. The total weight of the outfit is eight and three quarters pounds.



Motor Gives Rapid-Fire Action

BY CLAMPING a spring-motor attachment to the bottom of a leading make of miniature camera, users can turn an ordinary outfit into a "photographic machine gun" capable of snapping a dozen pictures in rapid succession. The attachment, designed especially for sports photography, permits sequence pictures showing the different stages of an action. They can be taken at intervals of either one half second or one second. A key at the bottom winds the spring motor. If fewer than twelve sequence shots are desired, the motor can be wound until the desired number appears in a window at the back. The camera can be operated independently, to obtain single pictures, while the motor attachment is in place.

Teeth Operate Shutter

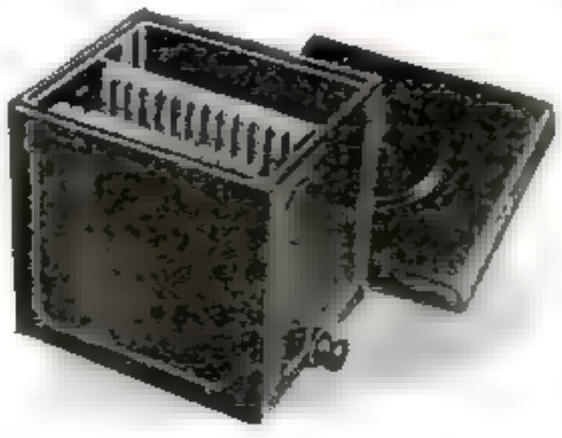
DEVISED by an Ohio inventor, a new cable-release attachment enables you to operate the shutter with your teeth, leaving both hands free to adjust the camera. The end of the release is clipped between the leaves of a rubber-covered spring held between the teeth. Biting down on the spring pushes the release plunger down.

Transformer for Floodlights

ORDINARY electric-lamp bulbs can be made to produce the brilliant illumination needed for indoor photography by using a compact transformer unit recently placed on the market. Lamps totaling 500 watts can be plugged into the unit at one time. With the switch at "low," they burn with normal intensity. After the camera is focused, the switch is moved to "high." This increases the voltage until, the manufacturer reports, the lamp gives off from five to six times as much light as normally. This high-voltage current reaches the bulbs only for the short interval while the picture is being snapped. The device is fitted with a convenient handle.

Bubbleproof Developing Tank

SPECIAL channels in the walls of a new hard-rubber developing tank carry the chemical solution downward so the container fills from the bottom, preventing air bubbles from forming on the films and producing blank spots on the negatives. Three sizes of plates, cut films, and film packs are accommodated by the stainless-steel holders within the tank. The negatives can be developed, fixed, and washed without removing them from the holders or the tank.

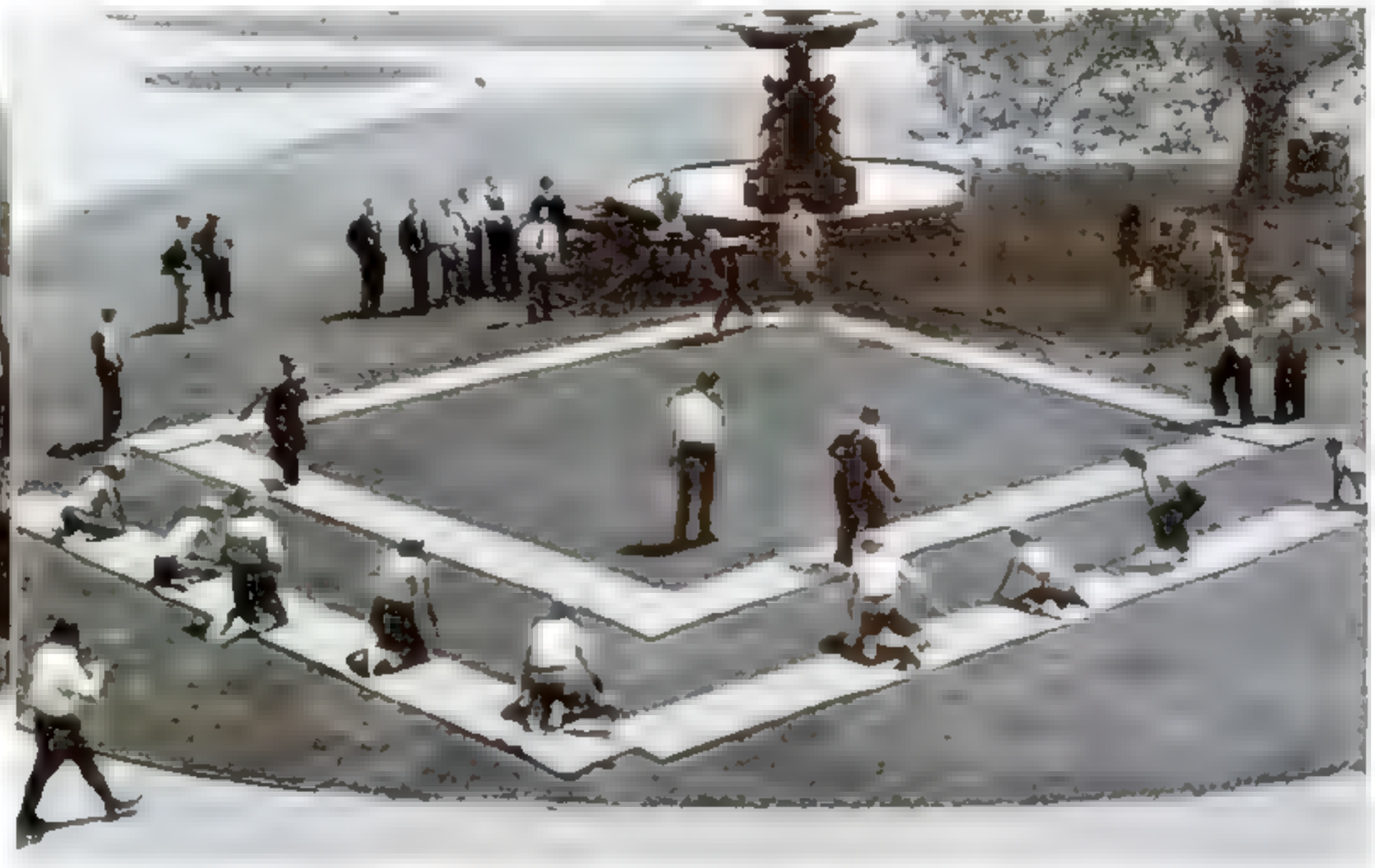


Stainless-steel holders accommodate three sizes of plates, cut films, and film packs in the tank

Carpets and Bells Guide Blind Ball Players

CARPETS three feet wide mark the base lines of a diamond specially prepared for blind baseball players in California. Using a soft ball whose hollow center contains a tinkling bell, the blind players are guided by bells and buzzers of various tones operated by an umpire from a central control box. When the ball is hit, one bell signals all players that it is in fair territory, and buzzers under each base inform runners that it is safe to start running in an effort to reach the next base.

With the control box above, the umpire rings bells at the bases informing blind ball players it is safe to run



Wind Models Aid Student Flyers

STUDENTS at the Boeing School of Aeronautics, Oakland, Calif., visualize movements of the air with the aid of graphic models made of transparent cellulose paper and cotton. Sheets of the paper represent major air movements, while cotton shows the turbulence that arises when two air masses meet. Models are studied in connection with meteorological charts.

Aeronautics students using the cotton model of air currents

McCarthy Now Stands on His Own Feet

CHARLIE MCCARTHY, famous dummy used by the ventriloquist Edgar Bergen, is no longer a strictly sedentary worker. Outfitted with a pair of ingenious wooden legs, Charlie can now perform his amusing antics while standing or in a variety of other positions at the will of his master.

Charlie McCarthy trying out his new legs

Taking samples of air to learn its effect on bridge paint

Analyze Air That Bridge "Breathes"

WHAT is in the air that a bridge "breathes"? Sulphates, coffee chaff, soot, and salt, among other things, according to tests on the San Francisco-Oakland Bay Bridge with a novel air collector devised by the California Division of Highways. Designed to collect air samples for later analysis of components in the atmosphere that are destructive to paint, the instrument has a wind-powered pump that forces air into a test bottle.

Archer's Arrow Smashes Bottle To Christen Airliner

STANDING on the wing of a new transport plane, a modern Robin Hood recently christened the craft by shattering with his arrow a bottle of ale suspended over the plane's nose from a long pole. An instant after the photograph was taken, the archer released the arrow. The steel-tipped shaft sped to its mark, smashed the bottle, and sprayed the contents down over the nose of the new airliner for the traditional christening.

Holder Guards Blasting Caps

Capped fuses for detonating explosive charges in a mine or quarry are carried safely in a new rubber container invented by R. J. Murray, Colorado mine inspector. A cylindrical rubber block has perforations in one end for inserting the capped ends of the fuses. If accidentally dropped, the rubber container absorbs the shock to prevent the blasting caps from exploding.

Fuse caps stuck into a rubber container to prevent explosion

No, He's Not a Fire Eater!

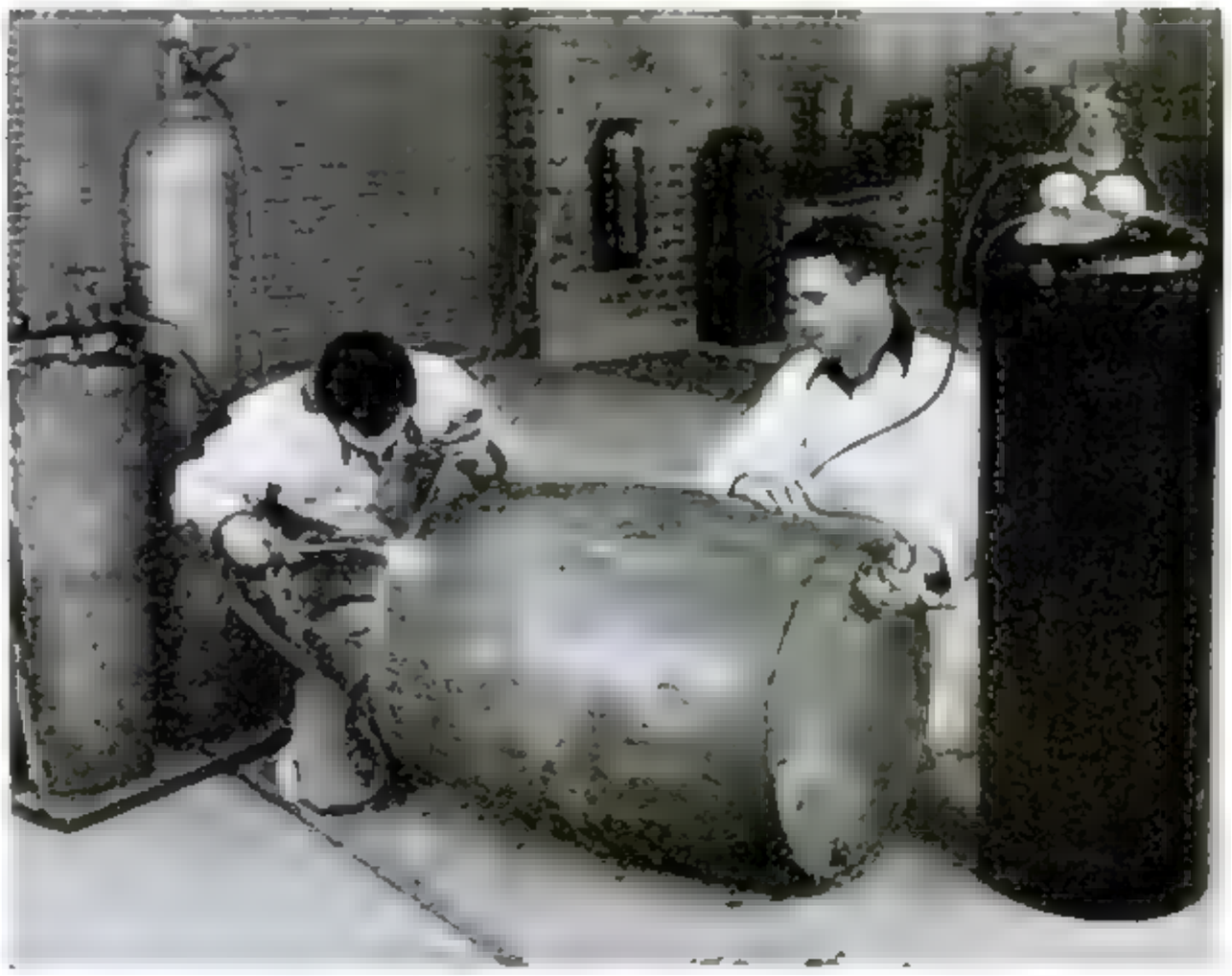
EXPERIMENTING with liquid air, whose temperature is about 330 degrees below zero F., a New Jersey hobbyist has devised amazing tricks. In one, he takes the frigid liquid into his mouth and blows it out as a cloud of "steam," as illustrated above.

Bike Saddles Get Shock Absorbers

EASIER riding is claimed for bicycle saddles equipped with a new hydraulic shock absorber that controls the action of the saddle springs. It is mounted as shown at the right.

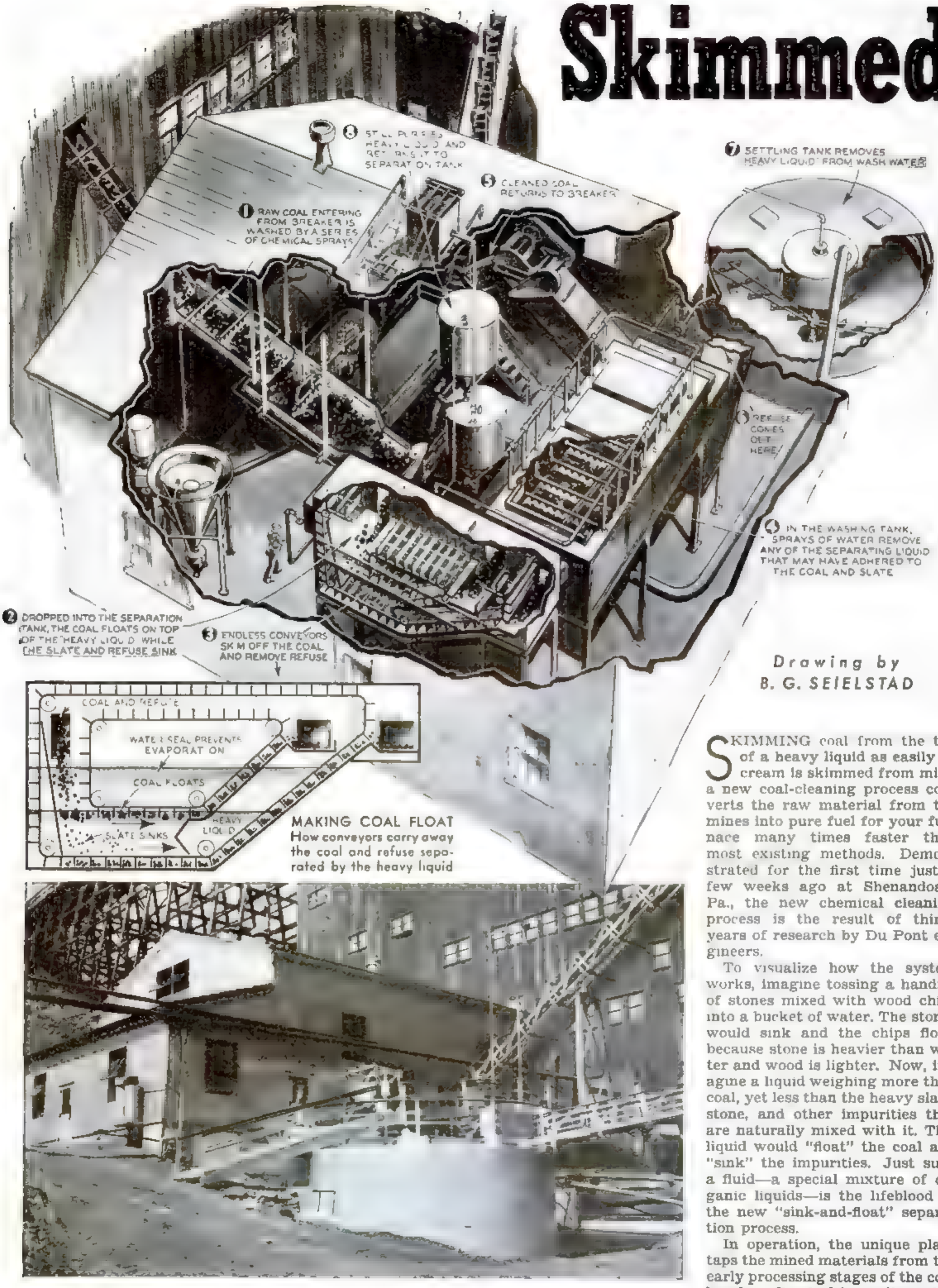
Gas "Fireproofs" Gasoline in Storage

TO REDUCE the hazards in handling gasoline and oil, especially in connection with airplanes, a new safety system employs an inert gas refined from motor exhausts. Introduced into fuel-storage tanks, it forms a protective blanket immediately above the liquid to prevent accidental combustion. A novel test of its effectiveness is illustrated in the photograph below, showing workmen welding a tank partially full of gasoline. The inert gas, introduced into the tank from storage cylinders, prevents the welding-torch arc from causing an explosion.



Gas forced into this drum blanketed the gasoline against a welding flame

Skimmed



MAKING COAL FLOAT
How conveyors carry away the coal and refuse separated by the heavy liquid

Drawing by
B. G. SEIELSTAD

SKIMMING coal from the top of a heavy liquid as easily as cream is skimmed from milk, a new coal-cleaning process converts the raw material from the mines into pure fuel for your furnace many times faster than most existing methods. Demonstrated for the first time just a few weeks ago at Shenandoah, Pa., the new chemical cleaning process is the result of thirty years of research by Du Pont engineers.

To visualize how the system works, imagine tossing a handful of stones mixed with wood chips into a bucket of water. The stones would sink and the chips float, because stone is heavier than water and wood is lighter. Now, imagine a liquid weighing more than coal, yet less than the heavy slate, stone, and other impurities that are naturally mixed with it. This liquid would "float" the coal and "sink" the impurities. Just such a fluid—a special mixture of organic liquids—is the lifeblood of the new "sink-and-float" separation process.

In operation, the unique plant taps the mined materials from the early processing stages of the coal breaker. Crushed to medium size, the coal and waste are first fed to washing screens. Powerful jets of

Dwarfed beside a huge coal breaker located in the coal mining region near Shenandoah, Pa., this building houses the equipment that separates pure coal from the waste that accompanies it from the mines. The tank in foreground settles used chemicals, which are distilled and returned to be used again

Coal

NEW SINK-AND-FLOAT PROCESS REMOVES SLATE AND SPEEDS PRODUCTION

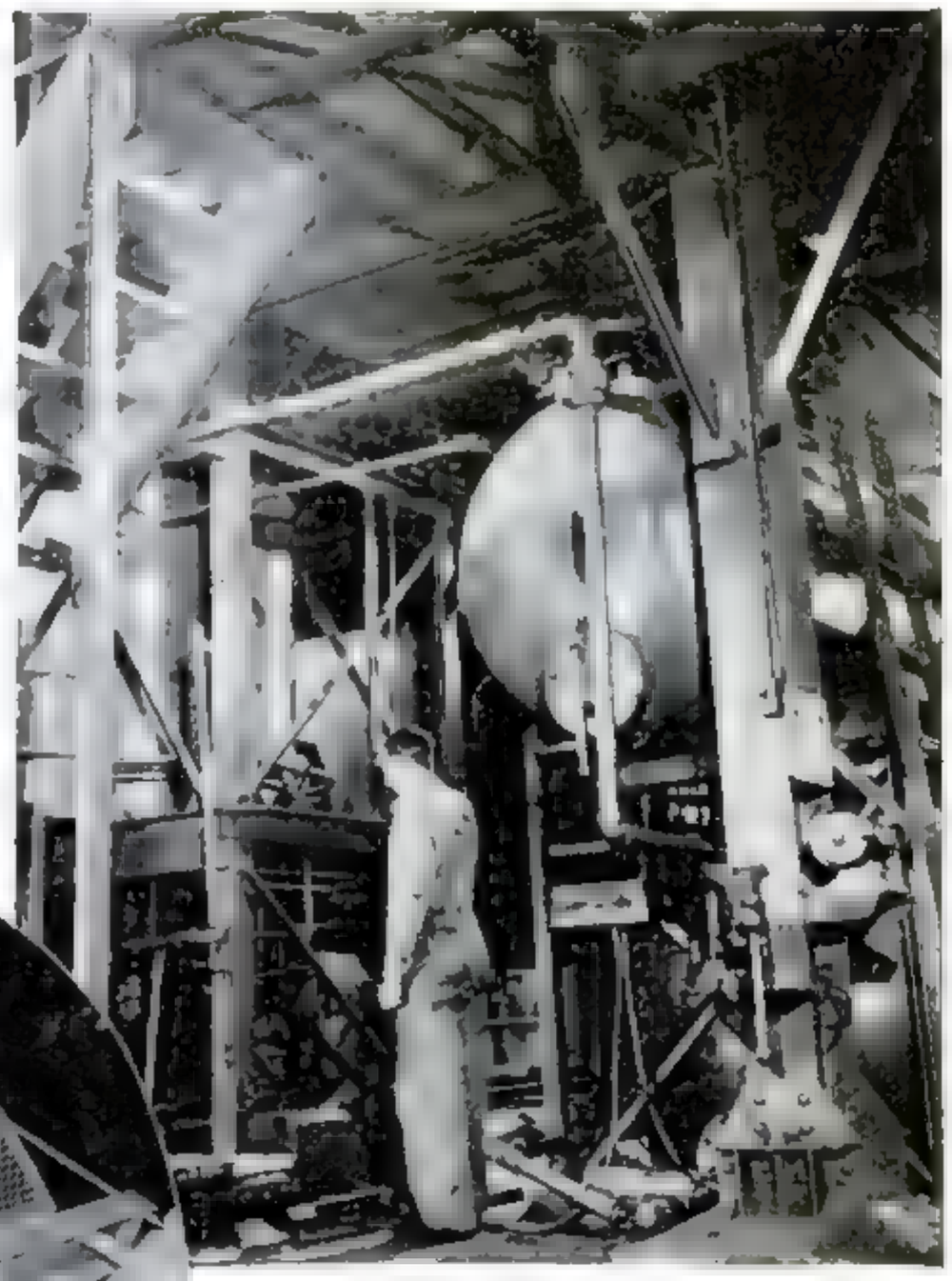
water spray the materials, removing loose dirt and silt. A chemical mixed with the washing water causes each particle to be wrapped up in a virtual blanket of water that will not run off. Finally, the materials are plunged into the separation tank containing the heavy liquid and a layer of water which floats on top like oil on vinegar and prevents evaporation. The stone and slate immediately sink to the bottom of the heavy liquid, while pure coal floats to its surface, underlying the layer of water.

Along the bottom of the tank, and at the dividing line of the water and heavy liquid, are chain conveyors. The lower one drags out the refuse. The upper one skims away the floating coal.

Strange to say, neither the refuse nor the coal has actually been touched by the heavy liquid, and therein lies the economic secret of the process. If the heavy liquid clung to the particles, it would be impossible to recover it cheaply. If it touched them, it *would* cling. What heavy liquid comes out of the tank with the chunks of coal and slate touches only the water "blanket" wrapped around them, and is easily washed off by water sprays. This wash water is then collected in tanks, as is the original wash water, and settling and distillation easily recover all the chemicals for use over and over again.

By varying the specific gravity of the heavy liquid, the process, according to its designers, can be used for the separation of many minerals.

In this demonstration, coal and slate dropped in a jar of the heavy liquid have separated, coal rising to the top



Right, workmen inspecting pipes connecting a chemical-storage tank with the coal-cleaning machinery of the plant

Below, coal completely freed of refuse coming from the machinery in a steady black flow on an endless-chain conveyor

Using a Heavy Liquid that Floats Coal and Sinks the Refuse that Comes with It from the Mines, Engineers Have Devised a Swift New Way of Cleaning Coal and Many Other Minerals

• • •

POPULAR SCIENCE Question Bee

Watch your step! For each of the numbered questions below, only one of the accompanying answers is correct. The others, no matter how reasonable they may sound, are put in just to fool you. See whether you can pick out the correct answer in each case, and make a note of the corresponding letter. Then turn to page 99 and check up to see what score you made

1 A juggler entertains people by maintaining objects in a state of *(a)* ionization *(b)* aerostation *(c)* suspended animation *(d)* unstable equilibrium *(e)* trial balance.

2 The things in your heart that pump blood into your arteries are called *(a)* mandibles *(b)* ventricles *(c)* spiracles *(d)* oracles *(e)* tentacles.

3 Hydrogen sulphide smells like *(a)* gardenias *(b)* burning sulphur *(c)* new-mown hay *(d)* rotten eggs.

4 The world's largest telescope, employing a 200-inch mirror, is to be installed *(a)* on Canton Island in the Pacific Ocean *(b)* atop Palomar Mountain in southern California *(c)* in the dome of the United States Capitol *(d)* on Mount Everest in the Himalayas.

5 Bank-and-turn indicators are used upon *(a)* bank-vault doors *(b)* racing automobiles *(c)* airplanes *(d)* roulette wheels.

6 What a community does for protection against a night air raid is known as *(a)* a fade-out *(b)* a black-out *(c)* a hide-out *(d)* bailing out.

7 The only mammals capable of true flight are *(a)* birds *(b)* bats *(c)* bumblebees.

8 Movies depend upon a phenomenon called *(a)* retinal fatigue *(b)* double refraction *(c)* persistence of vision *(d)* myopia.

9 If a tree is deciduous, it *(a)* stays green all the year 'round *(b)* bears edible fruit *(c)* grows only in tropical climates *(d)* sheds its leaves in the fall.

10 To assure us of a supply of the "No. 1 strategic mineral" in case of war, the U. S. Navy Department has placed contracts that encourage domestic mining of *(a)* gold *(b)* manganese *(c)* salt *(d)* diamonds.

11 The gram and liter are units of the *(a)* Culbertson system *(b)* metric system *(c)* Bedaux system *(d)* vascular system.

12 Silicosis is *(a)* a disease transmitted by parrots *(b)* the process by which trees become petrified *(c)* an ailment caused by inhaling rock dust.

13 The U. S. Department of Agriculture introduces and promotes the use of new foods such as *(a)* dinosaur eggs *(b)* cube roots *(c)* Jerusalem artichokes *(d)* wing nuts *(e)* niter cake.

14 One of a car's rear wheels is allowed to turn faster than the other, in rounding a corner, by a *(a)* universal joint *(b)* loose coupler *(c)* turnbuckle *(d)* differential *(e)* radius rod *(f)* Scotch yoke.

15 Whether people can read each other's minds is currently being tested with *(a)* devices that measure electric currents in the brain *(b)* packs of cards bearing emblems such as circles, squares, and stars *(c)* conversations over telephones with the transmitters removed.

16 An animal reverting to an earlier stage of evolution is called a *(a)* switchback *(b)* throwback *(c)* fullback.

17 To conserve filing space, books and documents are now being *(a)* squeezed into compact bales by hydraulic presses *(b)* photographed on motion-picture film for inspection through an enlarging viewer *(c)* read aloud for phonographic recording.

18 A device to read a graduated scale with high precision is known as a *(a)* vernier *(b)* decrement *(c)* terminator *(d)* megger.

19 Coaxial cables *(a)* support large suspension bridges *(b)* transmit television programs *(c)* operate small rotary tools through flexible shafts.

20 A substance that promotes a chemical reaction, without undergoing any chemical change itself, is called *(a)* an oxidizing agent *(b)* a reducing agent *(c)* a catalyst *(d)* an ester *(e)* an isotope.

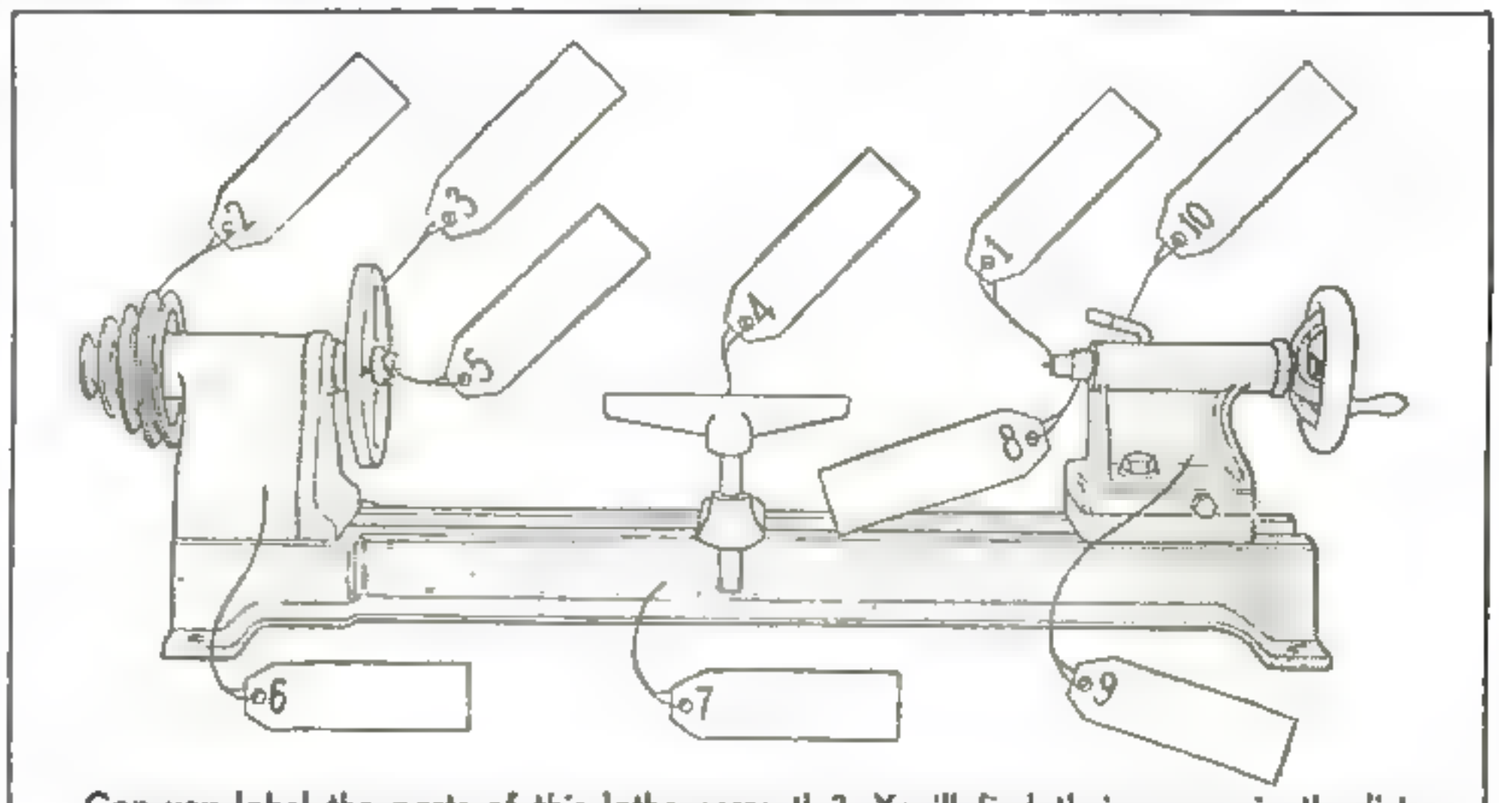
21 A rhombus is *(a)* a popular Cuban dance *(b)* a puzzle in which words or syllables are represented by pictures *(c)* a rain-bearing cloud of uniform gray color *(d)* a lozenge-shaped geometrical figure.

22 Wire of any desired size is produced by drawing the metal through a *(a)* bushing *(b)* mandrel *(c)* tap *(d)* die *(e)* pillow block.

23 A celebrated mirage is known as the *(a)* fata morgana *(b)* passo Romano *(c)* Mona Lisa *(d)* miasma.

24 What makes tap water sometimes look milky is *(a)* carbon dioxide gas *(b)* precipitated chalk *(c)* air bubbles *(d)* a compound formed from iron in the pipes.

25 A dangerous habit-forming drug, in which a widespread illicit traffic has developed in recent years, is called *(a)* curare *(b)* marijuana *(c)* tung oil *(d)* luminiferous ether.

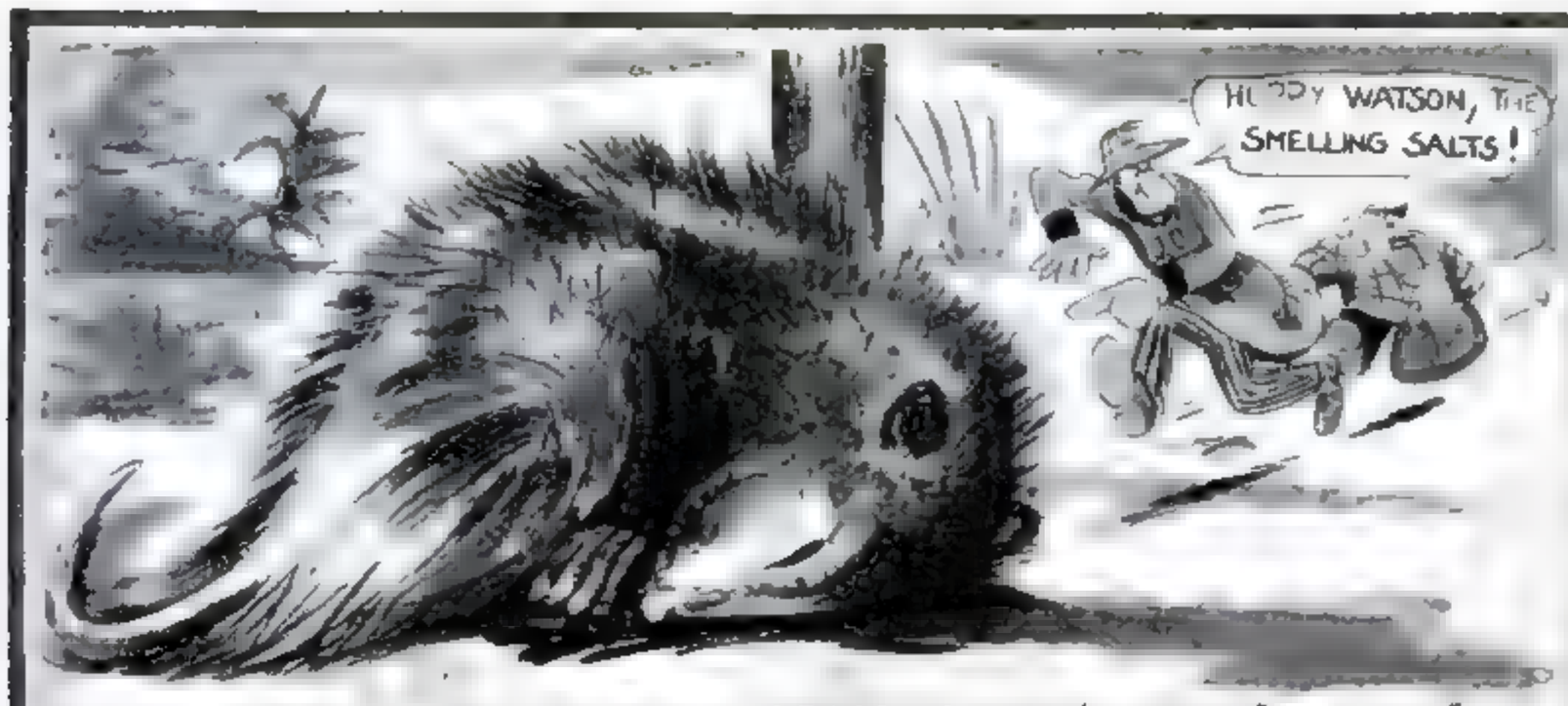


Can you label the parts of this lathe correctly? You'll find their names in the list below. Fill in the blanks and compare your labels with the answers given on page 99

spindle clamp, bed, dead center, cone pulley, faceplate, tailstock, live center, tool rest, headstock, tail spindle

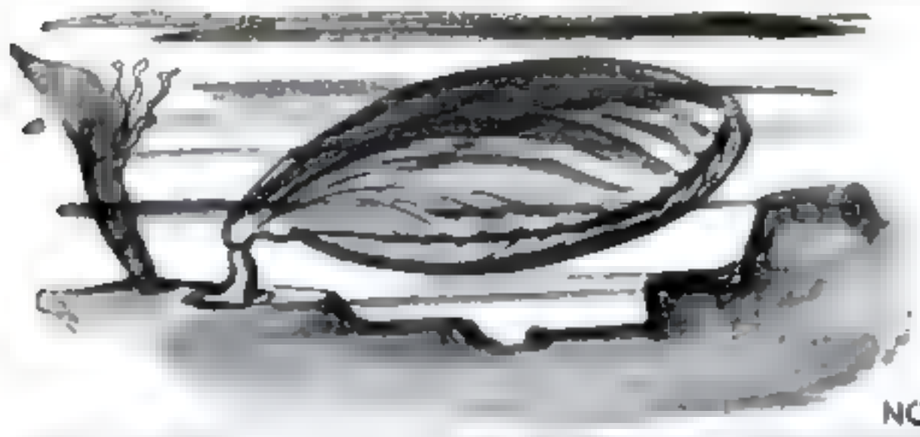
Un-Natural History

By GUS MAGER

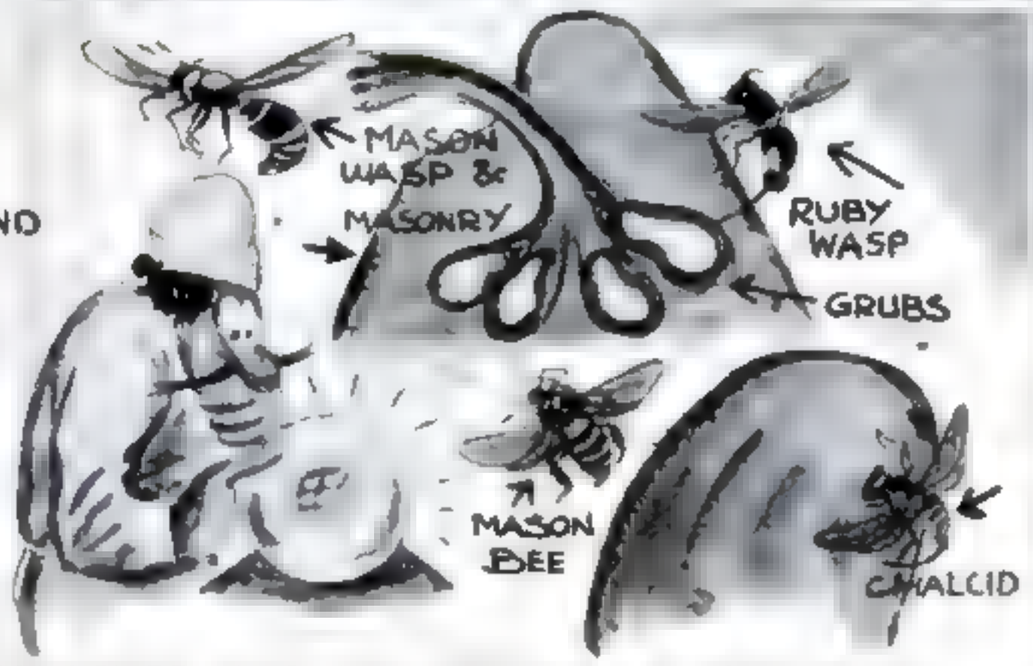


MANY NATURALISTS NOW SAY THAT THE OPOSSUM DOESN'T REALLY "PLAY DEAD" WHEN FACED BY DANGER, BUT COLLAPSES FROM FRIGHT! TESTS HAVE SHOWN THAT AT SUCH TIMES THE CREATURE'S BREATHING IS AFFECTED AND ITS SURFACE BODY TEMPERATURE IS LOWERED—IN OTHER WORDS, HE'S JUST FAINTED, THAT'S ALL!

WHEN TULIPS WERE INTRODUCED INTO EUROPE AROUND 1600, THEY STARTED A GAMBLING CRAZE! FORTUNES WERE PAID FOR RARE VARIETIES OF BULBS, UNTIL THE DUTCH GOVERNMENT SUPPRESSED THE "TULIPOMANIA" IN 1636!



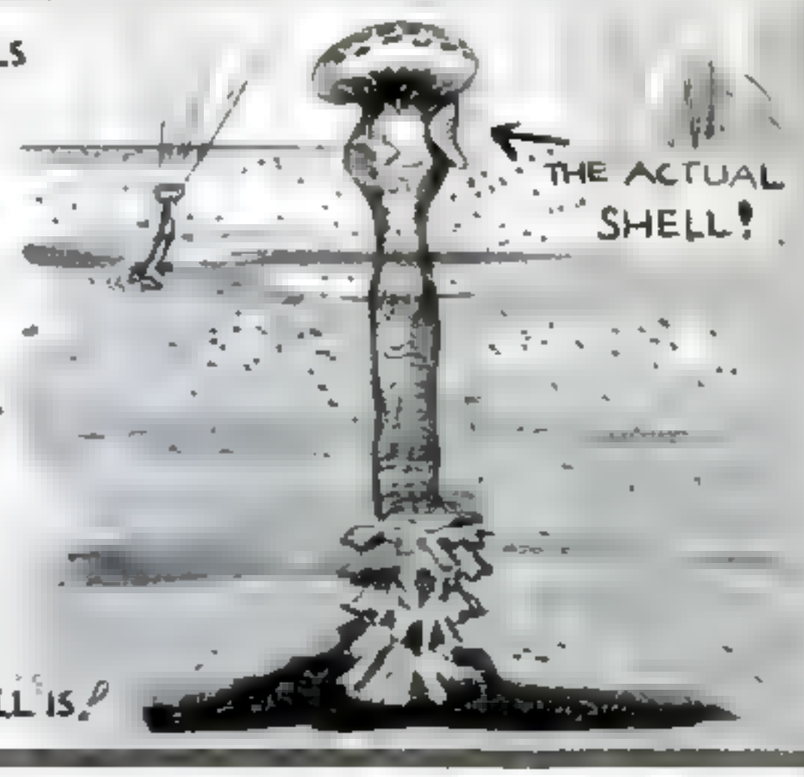
STRANGE SEA SHELLS CALLED LAMP SHELLS CAN HEAVE TO AND THROW OUT ANCHORS THAT HOLD THEM SO FIRMLY THAT EVEN THE HEAVIEST SEAS CANNOT TEAR THEM LOOSE! STRANGER STILL, THESE ODD CREATURES ARE NOT MOLLUSKS BUT WORMS!



SOME INSECTS APPARENTLY POSSESS A MYSTERIOUS POWER OF SECOND SIGHT! ONE OF THE PARASITIC RUBY WASPS STRANGELY SENSES JUST WHEN AND WHERE THE MASON WASP'S GRUB HAS FORMED ITS COCOON INSIDE THE SHELL OF HARDENED MUD, AND DEPOSITS ITS EGGS RIGHT ON THE COCOON! AND THE CHALCID FLY, ANOTHER PARASITE, SIMILARLY LOCATES THE MASON BEE'S CELLS THROUGH THE THICK WALLS OF THE NEST!

THE LARGEST PLANT IN THE SEA — AND THE TALLEST IN THE WHOLE WORLD— IS THE ANTARCTIC LAMINARIAN SEAWEED WHICH GROWS UP TO 1,000 FEET LONG!

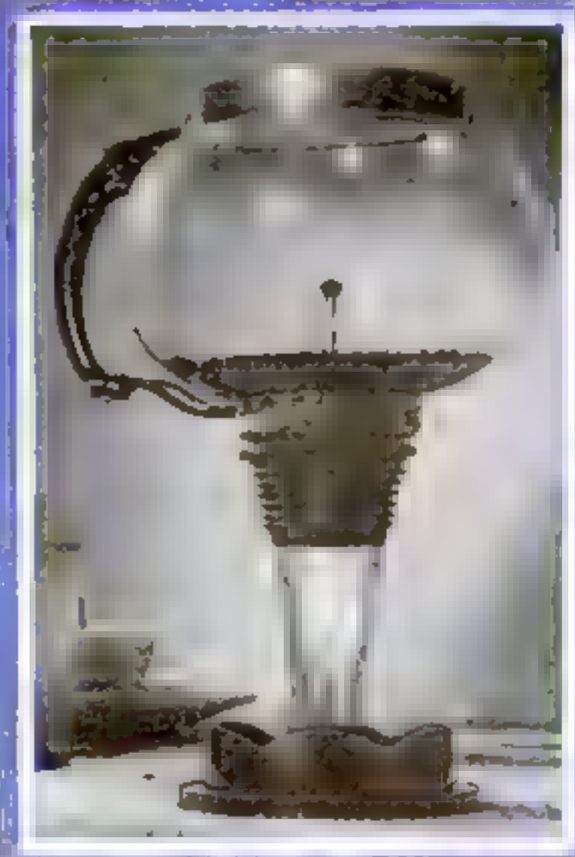
LIKE A HUMAN HOUSEWIFE, THE POCKET MOUSE GOES MARKETING WITH HER SHOPPING BAG. IT IS THE ONLY NORTH AMERICAN MAMMAL THAT HAS EXTERNAL POUCHES FOR CARRYING FOOD—REAL HAIR-LINED POCKETS IN THE CHEEKS FOR BRINGING HOME THE BERRIES!



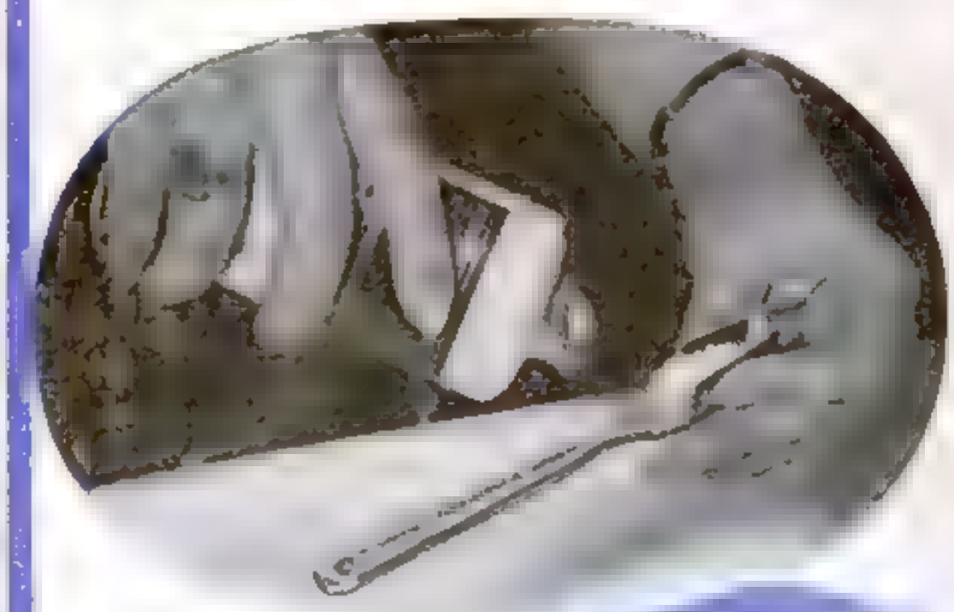
QUEEREST OF ALL SHELLS THAT ANCHOR THEMSELVES IS THE WATERING-POT SHELL FOUND IN THE RED SEA. WHEN EXCITED, THE ANIMAL SPRINKLES WATER THROUGH HOLES AT THE TOP OF ITS BONY TUBE! ITS RUFFLED ANCHOR IS SO FIRMLY MOORED THAT THE CREATURE MAY BE TORN APART WITHOUT THE ANCHOR GIVING WAY! AND SEE HOW SMALL THE ACTUAL SHELL IS!

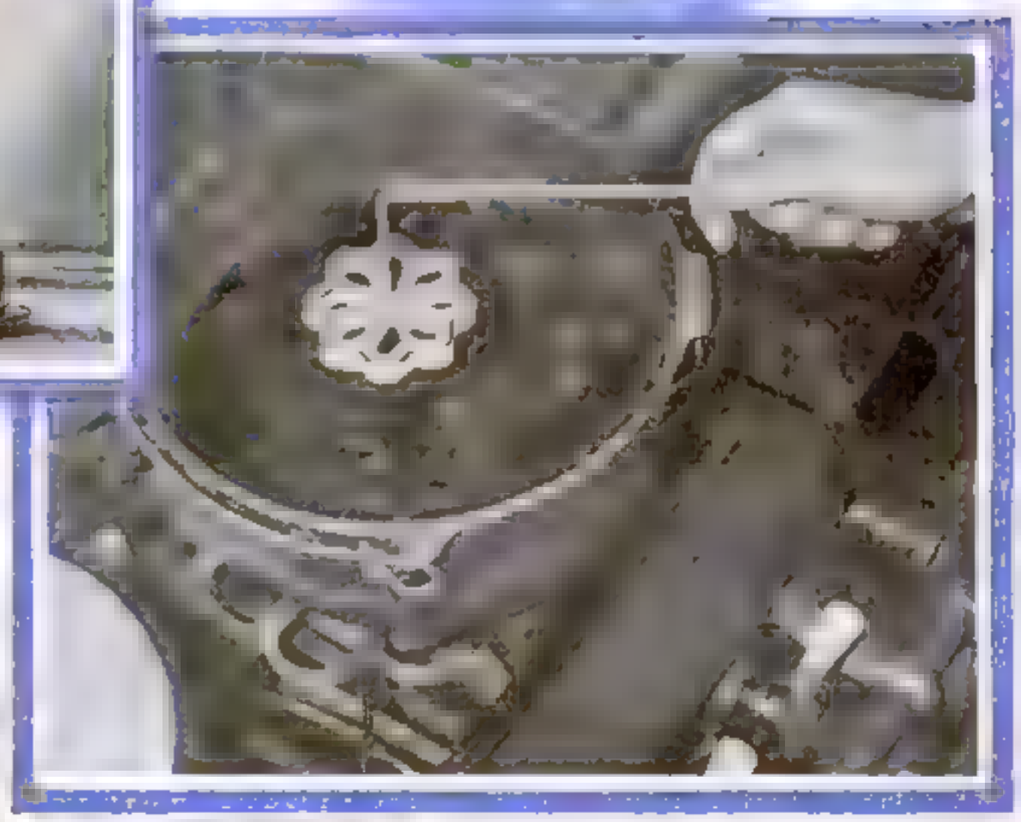
New Appliances

HOLDER FOR COFFEE MAKER. A handy feature of a new vacuum-type coffee maker is a special holder in which the top section may be set, as seen at right, after the coffee is made. A container catches the late drippings

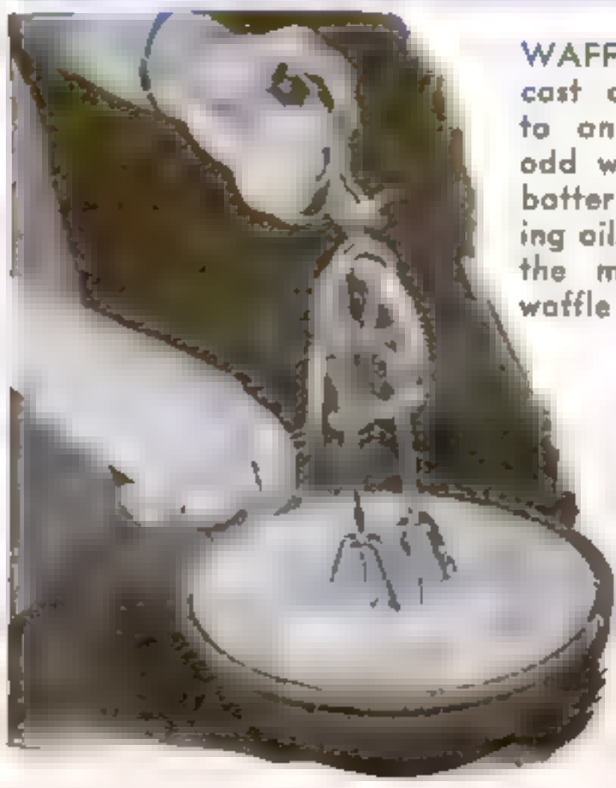


TOOTHBRUSH AIDS. Slipped around the head of a toothbrush, the metal guard below prevents waste and mess in using powder. The lower picture shows a novel dispensing cap for tube products, which allows paste to pass through and then closes itself automatically





SWING-OUT BROILER. Attached to the door of a new gas range, the broiler compartment illustrated below swings out of the oven for easy inspection, turning, or removal of broiled foods



WAFFLE MOLD. Made of cast aluminum and attached to an L-shaped handle, this odd waffle mold is dipped in batter and placed in hot cooking oil. As the batter expands, the mold is lifted and the waffle automatically drops off

ADJUSTABLE EGG BEATER. Set at any convenient angle, the handle of an improved egg beater is equipped with an adjustable grip that makes it easy to use. Special design of the dasher blades is said to end splashing

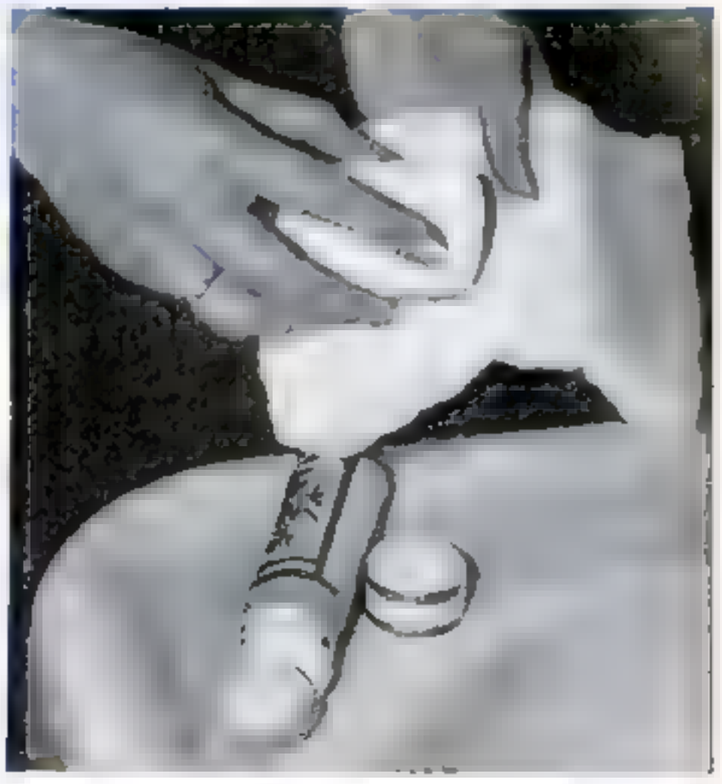
for the Household

FAUCET WATER HEATER. Hot water is produced right at the tap by the electrical fixture pictured below. Turning the hot-water faucet automatically switches on an electric arc that supplies the heat

EXPANDING MIXER. Operated by pumping the handle up and down, the ingenious mixer below has a dasher unit that is expanded by centrifugal force to conform to the size of any vessel, from a wide bowl to a small jar

BUILT-IN DISHWASHER. Installed in a standard sink cabinet, a new electric dishwasher opens from the front. The interior is lighted automatically when the door of the washer is opened

REFRIGERATOR-BOTTLE FAUCET. Liquids are drawn from this refrigerator bottle by pressing the button on the self-venting faucet, which is not affected by acids in fruit juices or wine



COMPRESSED WASHCLOTHS. Cotton washcloths, compressed into small disks and packed in a cardboard cylinder, are handy in traveling. Placed in water, each swells into a thick pad six inches square

FOLDING GARMENT RACK. Mounted on a closet door, the rack shown at the left holds six clothes hangers. The horizontal bar swings up and locks in place, holding garments in small space

Harry filled the barrel, and Gus clamped the motor to a block of wood in the vise so that its propeller was in the water. Then he poured fuel in the tank and pulled the starting cord

• GUS GIVES SOME TIPS ON

Outboard Motors

By MARTIN BUNN

IT WAS a midweek afternoon in the Model Garage. In the little office, industrious Joe Clark was happily engaged in making out the customers' monthly statements. From the depths of the greasing pit outside came, hollowly, the voice of Harry, the musical mechanic, raised in lugubrious song. Gus Wilson listened to it as he took apart a balky carburetor. "Why don't these kids ever sing anything cheerful?" he wondered, his thoughts on the ragtime of his youth.

A car stopped in the driveway, and Gus heard the crunch of footsteps on the gravel of the yard. Then a peppery voice snapped:

"Mr. Wilson, I've been defrauded!"

Gus didn't have to look up to know that it was Professor Clapp. The professor had been staying up at his cottage at Coldspring Lake since the closing of the local high school over which he tyrannized, and the Model Garage hadn't seen much of him.

"Hello, Professor," Gus said, grinning. "What's that—you've been defrauded? Well, just step into the office and talk to Joe Clark about it. He's the fellow who takes care of that branch of our business!"

Professor Clapp refused to smile. "It isn't the Model Garage that has defrauded me—this time," he conceded grudgingly. "It is another—another dealer in motors. And in addition to being cheated, I have been made to look like a fool before every one at Coldspring Lake!"

Gus had to bend over his workbench to hide a grin. Before he dared to raise his head, another voice joined in the conversation with: "Why Father, it really wasn't *that* bad!" The voice belonged to an auburn-haired young woman with violet eyes and a piquant, freckled face, dressed in a play suit that revealed a generous length of sun-browned legs.

"Why, Bev!" Gus said, wondering at the remarkable transformation that a couple of years away at school had made in the professor's scrawny, red-headed daughter. She smiled at him, and called "Bring it in, Harry, please." Harry, beaming through the black grease with which his face was liberally smeared, came in carrying a large brown canvas bag that seemed to be heavy.

"It's just this outboard motor, Mr. Wilson," Beverly Clapp started to explain. "Father has had a little trouble—"

"My dear, I'm quite capable of explaining this unfortunate affair to Mr. Wilson!" the professor snapped. "For many years, Mr. Wilson, I have been an ardent devotee of the pastime of rowing. But my daughter, like all the young people of this unfortunate time, has succumbed to the lure of speed. All summer she has been pestering—has been trying to induce me to buy an outboard motor for my boat. While we were spending a few days at the seashore last week, I yielded. From a dealer said to be reputable I purchased, second-hand, this outboard motor.

"I took it to our cottage at Coldspring Lake. Following the dealer's instructions to the letter, I attached it to the stern of my boat. After some little effort, I started it. For a few minutes it ran smoothly, and I confess that I found the swift motion through the water enjoyable. But my enjoyment was short-lived. The motor began to make a terrible rattling racket. It would slow down, nearly shaking me to pieces, almost stop, then run again at its full speed.

"The erratic movements of my boat, together with the insufferable noise of the motor, attracted the attention of my neighbors sitting on their lakeside lawns and of the crowd of young idlers on the yacht-club float, who soon were roaring with empty-headed laughter. Hoping that among them there might be one with sufficient intelligence to adjust the infernal contraption, I headed for the float.

"When I was close to it, I pressed the button marked 'stop,' as directed by the dealer. The motor did not stop. Instead, it speeded up without warning. I crashed into the side of a canoe, doing considerable damage. In my frantic efforts to turn back into open water, I somehow reversed the motor, causing my boat to run backward into a new mahogany runabout, and seriously mar its finish.

"At last I succeeded in getting my boat back into the open lake. My further efforts to stop the motor were fruitless. So I had to circle around and around, now fast and now slow, listening to the laughter and jeering remarks of the idiots on the float. It wasn't until my fuel was exhausted, and the motor stopped, that I was able to row back to my cottage. *Never* have I been so humiliated!"

Harry was grinning openly. Gus tried to keep his face straight as he leaned over the outboard and started to take it out of its bag. "It's a long time since I've had anything to do with these put-puts," he said, "but maybe I can put this one right."

"Put-put it right," Bev said demurely. That gave Gus *(Continued on page 101)*

BUILDING A Contest Winner

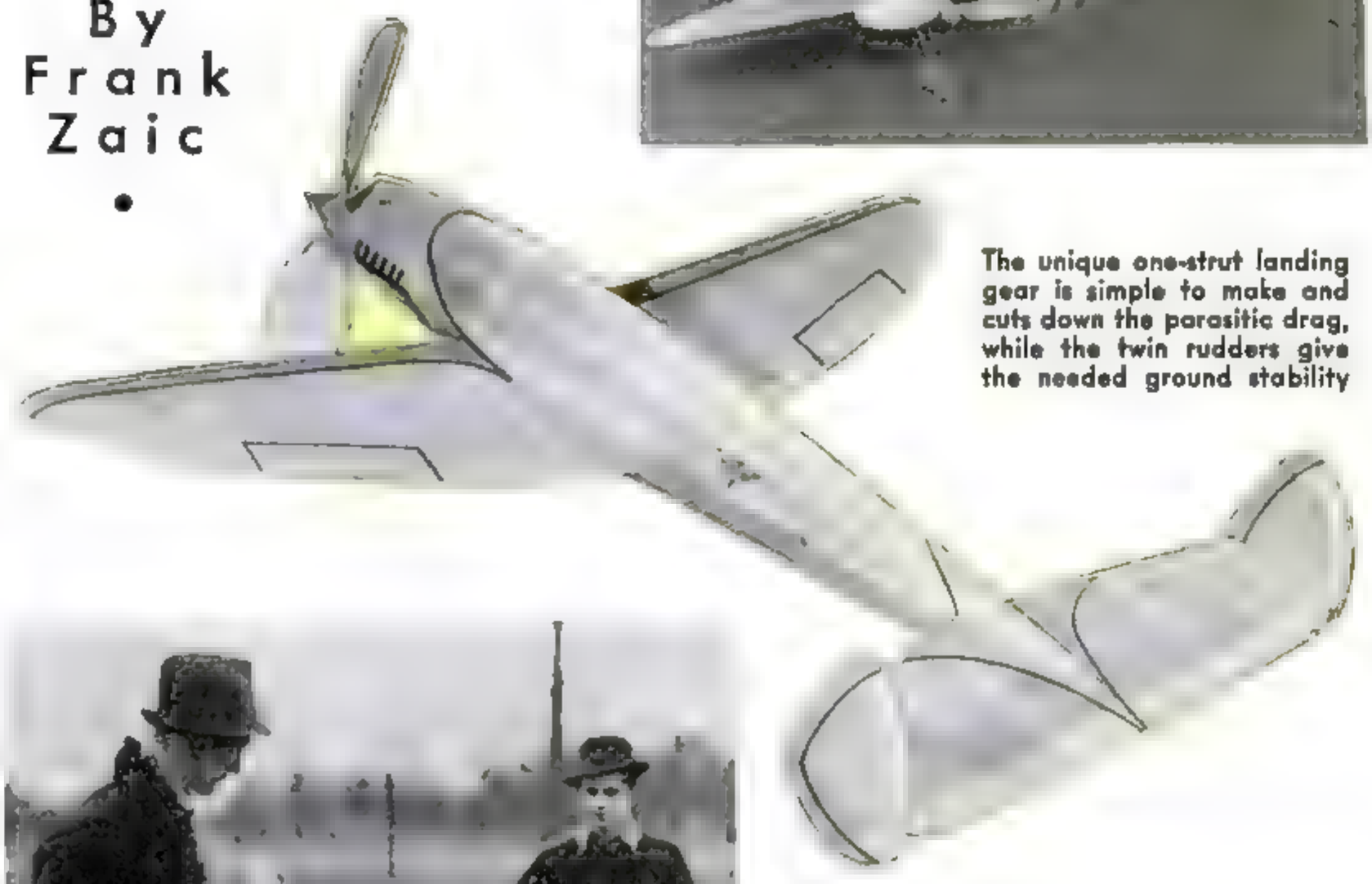
SPEEDY MODEL PLANE EMBODIES NEW IDEAS

By Frank Zaic

SEVERAL new ideas for the 1938 contest season are embodied in this easily built model plane, the Experimenter No. 3. First is the single strut landing gear, which reduces parasitic drag, and the double rudders to provide ground stability. Second is the simplified keel construction, which aids in streamlining. Third is a new method of making a propeller spinner and an improved rear-hook assembly.

Fuselage. The precut upper and lower longerons are shaped from sheet balsa after the plans have been drawn full size. Place the balsa sheet under the drawing and prick pinholes along the curve. Then superimpose the side longerons over the plan and pin in place.

Set the upper longeron above the sides with temporary supports and cement in the braces. The end of each brace that is glued to the side longerons is cut at an angle, but the other end is allowed to protrude and cut to size after the brace has been fixed. When all the braces are in place and cut, cover the upper longeron with a soft capping strip. Cement temporary cross braces in place, and remove the assembly from the pin jig.



The unique one-strut landing gear is simple to make and cuts down the parasitic drag, while the twin rudders give the needed ground stability

Starting to wind the motor, which consists of six strands of 1/8-in. rubber. The model has a wing spread of 20½ in.

Make the lower portion similarly, but before completing the nose, make the plug from balsa as shown, with a square piece cemented in the rear. Using the plug as a guide, fill in the nose portion with ⅛-in. sheet balsa. Arrange the rear hook as shown. The brass bushings are best inserted before the upright pieces are cemented in place. Cement the 1/16-in. square stringers as indicated. The landing gear may now be cemented in place.

Wing. Make a full-size drawing and cut ribs and trailing edges to shape from sheet balsa. The edges are made like the longerons. Cut all ribs the same size because they are tapered by measuring the distances from the spar cut-in to the leading and trailing edges. Before cutting off the lower flat camber, make the two tapered spars, ⅛ by ⅜ in. at center and ⅛ by 3/16 in. towards the tip. Mark the rib positions on them and insert the corresponding rib. Note how much the rib protrudes below when the spar is pushed into the slot, and cut off the excess. Towards the tips, the rib ends may be larger than the edges, but just sand the upper camber to suit.

The wing is made in two pieces. First slip the ribs on the spar while it is superimposed on the drawing; then cement the precut trailing edges. Bend the leading edge while cementing it.

Remove from the jig, sand trailing

Complete working drawings of the Experimenter No. 3, with a scale in inches. The design is by Zaic, construction by Roger Hammer

edge to taper, clean up tips, and bevel spars for the proper dihedral angle. Cement the two wing halves together, being sure they have identical incidences. Finally, cement 1/64-in. sheet balsa along the leading edge as shown.

Stabilizer and Rudder. Follow the drawings and be sure the wood is strong. The rudders are fixed to the stabilizer after they are covered. An extra cement coat over the rudders will allow adjusting without cracking.

Covering. Use yellow paper, covering wing and tail first. Then cement wing to fuselage. Run an extra piece from the side longeron to the center spar through the paper. Cover the fuselage, and use several small pieces at fuselage and wing junction. Note that 1/64-in. balsa is used on the section behind the nose plug. Mist-spray the whole job and coat with clear dope.

Filleting can be done, if desired, by cementing a piece of sheet balsa to the trailing edge and then filling the deep triangle with stiff writing paper. Paint the nose and wing with blue dope or enamel approximately as illustrated. Masking tape will help in outlining the painted area.

Propeller. Note that the blank is tapered from the center to the halfway point before the carving is begun. The lower camber is first completely carved and finished, and be sure to give a bit of undercamber. The upper camber is carefully cut to correspond and so that it tapers from the center out, forming a sort of airfoil. The outline is easily made if the sharp corners where the various diagonals cross are rounded before carving; then only the tips need shaping after carving. Sand smooth and apply several coats of dope and a final coat of color after the spinner and freewheeler are fixed.

Cement disks of balsa on the hub so the spinner shape can be built up by cementing several balsa strips to them. If the propeller shaft is fixed and no freewheeling is used (in that case, in-

crease the dihedral to 3 in. to take care of the still prop in the glide), extend the strips to a point, and also extend them over the larger disk to cover the ball-bearing washer. If freewheeling is used, make a balsa cone tip and cement it to the winding end of the shaft. Insert the shaft into the plug bushing and bend the motor hook. Note the extra hook-back on which a rubber band is started and ended to bind the hook into a ring when the rubber is in place.

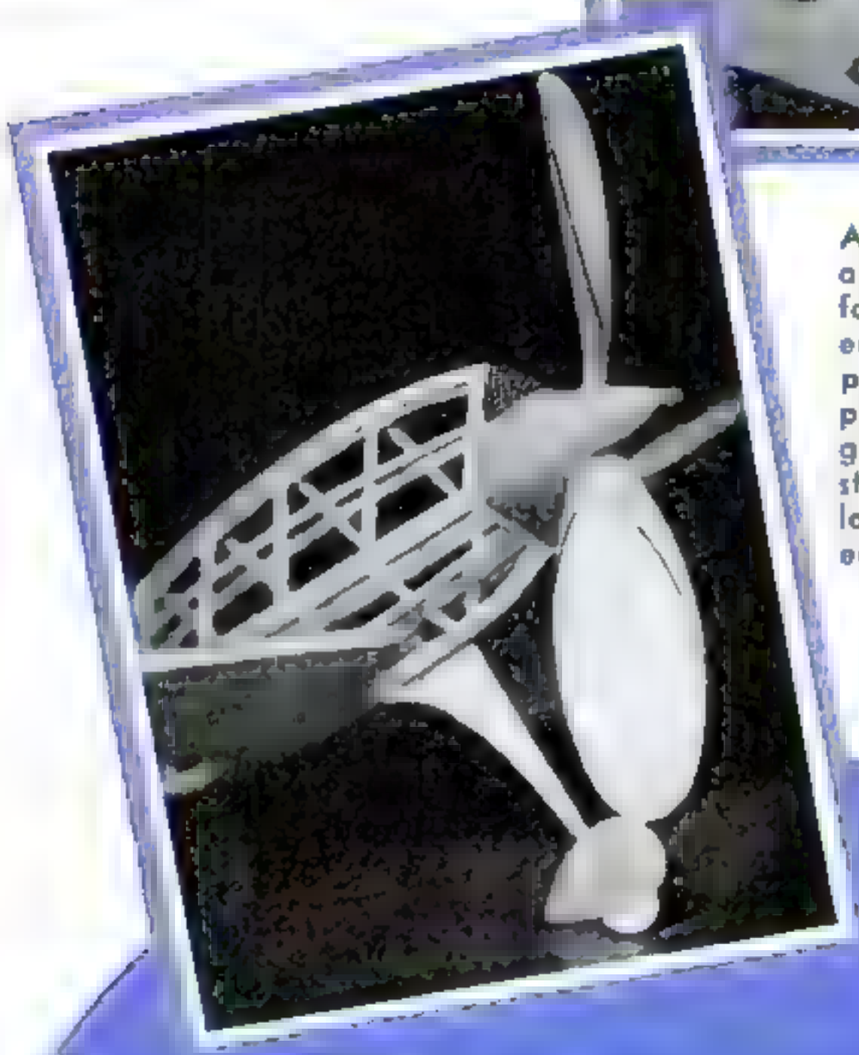
Checking and Flying. The motor—six strands of ⅛-in. flat rubber—is inserted by dropping it through the nose opening. A rear opening is not essential because the motor can be seen by holding the model in front of a light or against a bright, sunny sky. When the rubber end is in position over the rear bearings, the pin is pushed through. If a small opening is made at the rear, the rubber may be threaded through with a wire hook, and the hole covered with cellulose tape.

The model balances by holding it at the tips where the spars are. If necessary, add a bit of modeling clay to bring the center of gravity to about this point. Check the incidence and look out for warpage, especially on the stabilizer.

WHEN it comes to inside dope on contest flying, model airplane champions everywhere rely on Frank Zaic's "Model Aeronautics Year Book." An outstanding authority in his field, he gives in this exclusive article his ideas for improvements it will pay to use

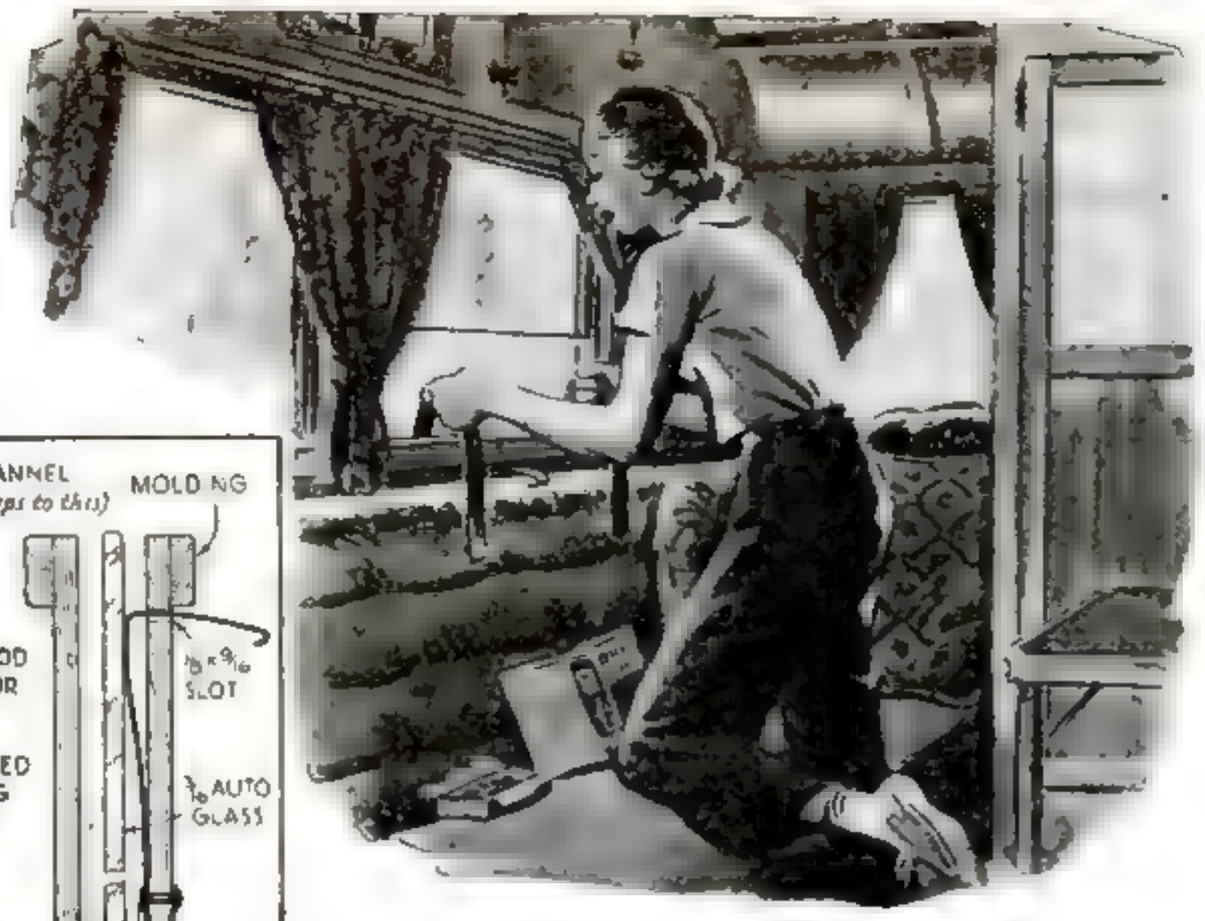
Set the model on ground, lift the tail slightly, and give a gentle push. It should rise about a foot off the ground and commence a shallow glide. Then wind the motor about 100 turns. After that, if conditions permit, try it fully wound. If tests are unsatisfactory, check for warpage. Bend up the stabilizer's trailing edge to correct diving.

The original model has been duplicated several times, and every one has performed well. One was a high-speed job that clocked about 50 m.p.h., but solid wings and a hardwood prop with plenty of power were used. In calm weather with light risers, a minute and a half was clocked, and the model has traveled well over 1,000 ft. in windy weather.

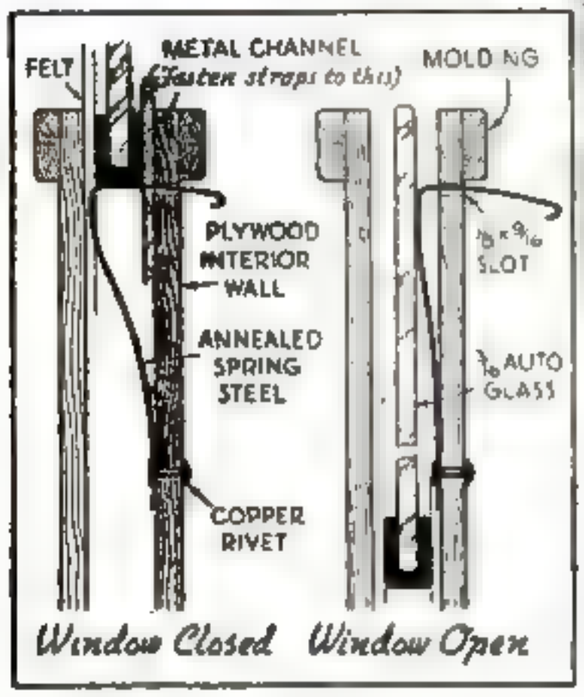


Assembled wing and fuselage before being covered. Left, the propeller, nose plug, and landing gear. Right, the streamlined fuselage is unusually easy to construct

The wing framework superimposed over a full-size drawing. Actually, the wing is made in two halves, the ends of the spars are beveled to give a dihedral angle of 2½ in., and the parts then cemented together. Left, ready for covering



The glass, which slides in felt channels, is kept closed by flat springs applied as shown below



Easy Method of Installing Windows in House Trailer

IF YOU desire to install rattleproof windows in a homemade house trailer, but cannot afford expensive hardware, this device will serve the purpose very well. The window is pulled up by means of a strap, and a light steel spring keeps it in position. Large windows require two springs and two straps.

Paint the inside of the window wells with asphaltum paint and provide for drainage at the bottom. Tack felt channels along the inside of sides and top of the window opening. Have auto glass cut and ground to run smoothly up and down between the channels. Attach a metal window channel to bottom of glass and fasten a cotton web trunk strap to this to pull the window up.

For the spring, use annealed steel from an old, heavy clock spring or obtain a piece of annealed spring steel about 1/32 in. thick and ½ in. wide. Bend to shape, round all corners, and polish; then retemper and install. Cement felt to the spring where it touches the window glass.—FLOYD M. MILLER.

Horseshoe Coat Hooks Symbolize Good Luck

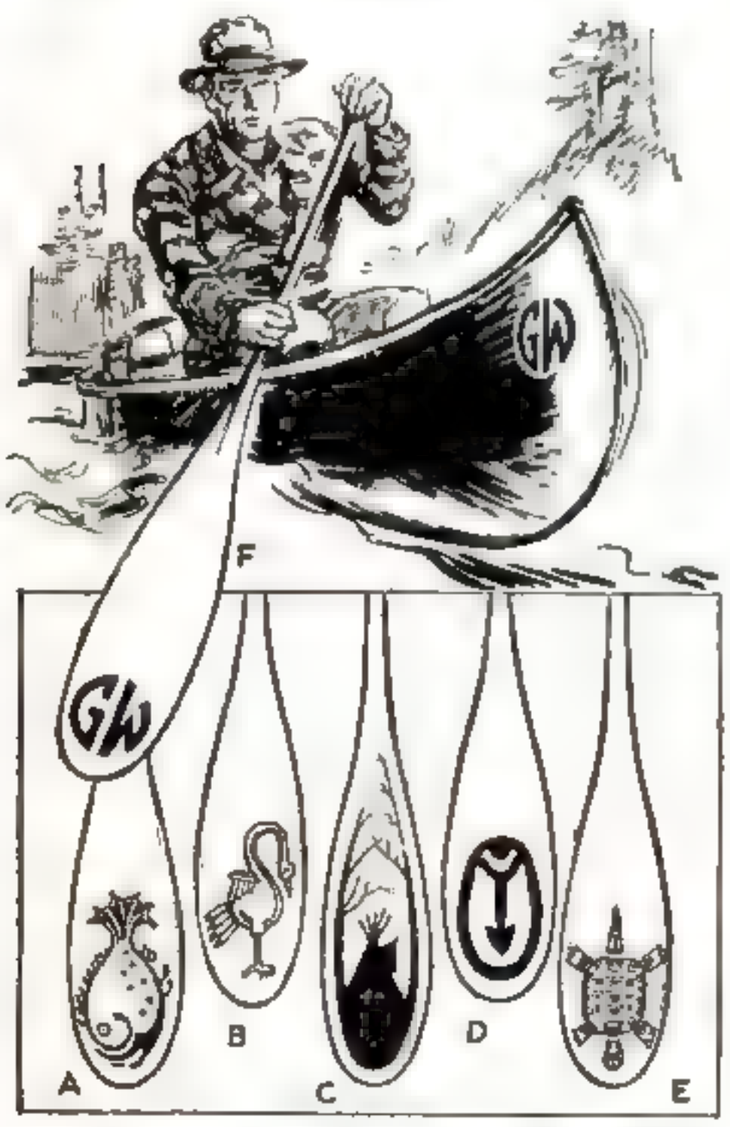
OLD horseshoes, which have so long been a symbol of good luck, may be converted into attractive coat hooks or costume hangers for use in a cabin, ranch house, hunting lodge, or any place where there is an interest in horses. Heat the calk part of one end of the shoe, hammer it to form a flat surface, and make a half twist an inch or two from that end so the shoe may be screwed against the wall as shown below or on a costumer. A dull oxidized iron finish may be given the shoe by applying sufficient heat to make the iron red-hot.—GEORGE A. SMITH.

One end of the shoe is heated, hammered flat, given a twist, and drilled for screws

Six Painted Emblems for Canoe Paddles

CANOEISTS can give a touch of individuality to their equipment by decorating their paddles. Six designs are suggested. *A*, for example, is appropriate for a fisherman, *D* for the canoeist who likes swift streams and rapids (the design being the Indian totem for "swift current"), and *E* for an expert swimmer. First draw the selected design on a large piece of paper, then transfer it to the blade of the paddle.

Paint with bright colors, especially *A*, *B*, and *E*, and when dry, outline the designs in black or dark blue, and apply two coats of transparent spar varnish. The same design may be used smaller in a circle on both sides of the canoe at the bow as at *F*.—GRAY WOLF.



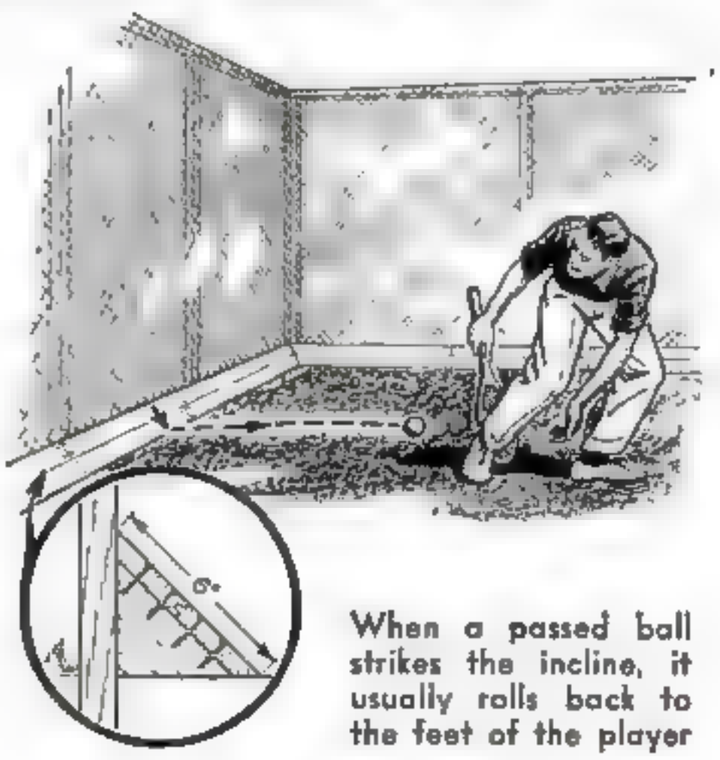
The chosen design is brightly painted on the canoe paddle and repeated at the bow

Glass Used as Glue-CanTop

MUCH better than the metal cover of the conventional liquid-glue can is a small glass caster cup of the type used under table legs. Placed upside down over the opening, it never sticks because the glass does not touch the rim of the opening. It also serves as a convenient place on which to lay the paddle or brush.—DONALD R. FOSLER.

Tennis-Court Edge Returns Passed Balls

MANY tiring steps to retrieve tennis balls may be saved by placing a 45-deg. incline along the entire length of the backstop and side walls of the court. The incline can either be permanent or made in removable sections of convenient length. It is formed by nailing ¾-in. boards to 45-deg. supporting blocks about 1 in. thick, placed from 4 to 5 ft. apart. The width of the incline should not be less than 4 in. A good job can be done by using two 3-in. strips of tongue-and-groove flooring, as shown. With this width, most passed balls will return almost to the feet of the player at the base line. A coat or two of paint will help protect the wood from decay.—K. F. KEITH.

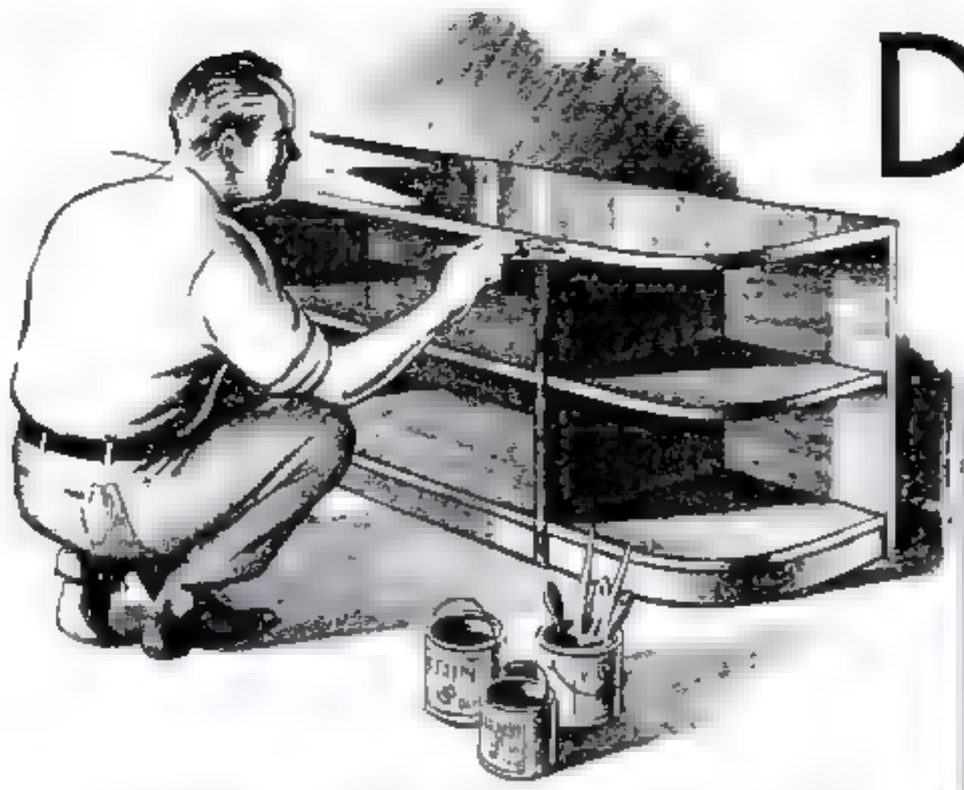


When a passed ball strikes the incline, it usually rolls back to the feet of the player

aug 1938

Dwarf Bookcase

FITS UNDER WINDOW



Besides holding books, this useful piece of built-in furniture has an extra wide top that serves as a table

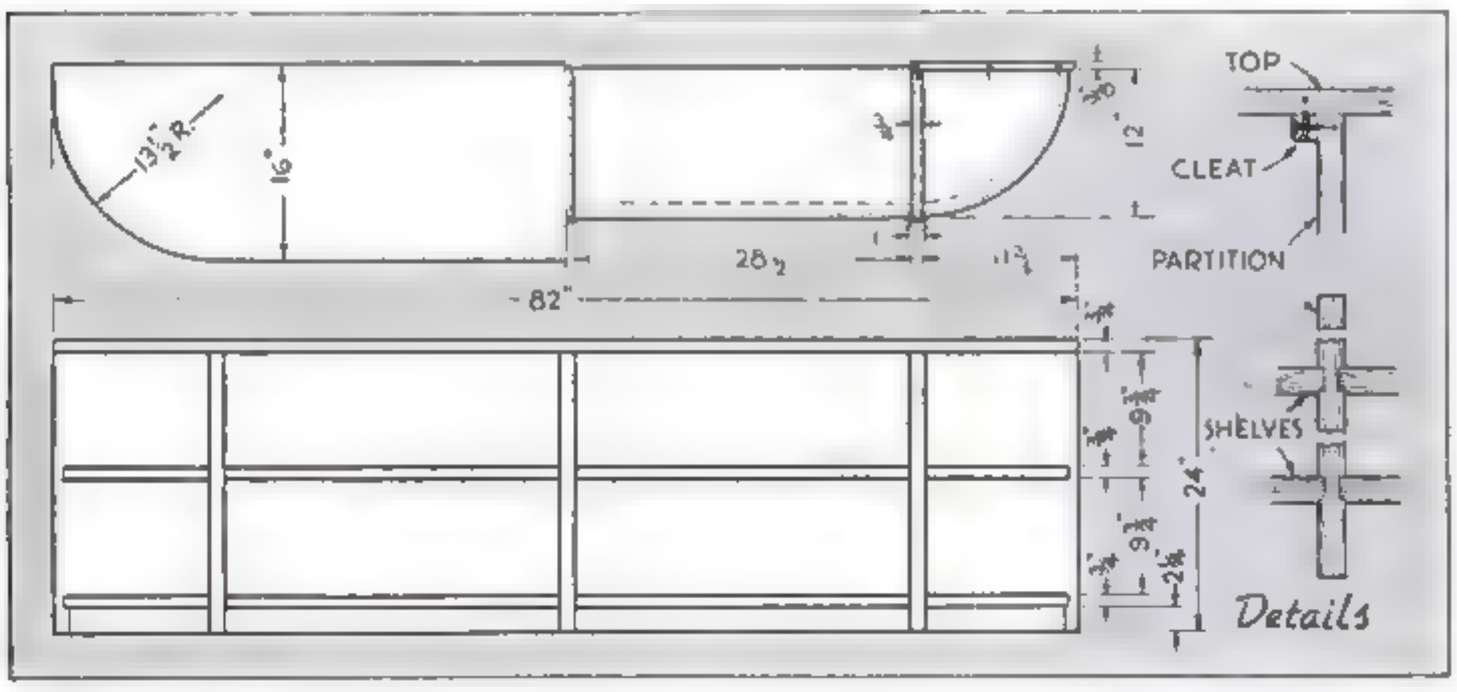
LOW bookcases, built to fit under wide windows, are very useful and add much to the appearance of a room. In the design illustrated, the top is wide enough to serve as a table, and the modernistic end compartments may be used for other things besides books, such as bowls, vases, smoking accessories, large magazines, or sewing materials.

The dimensions should be modified to suit the window under which the case is to stand. After cutting and planing the partitions and shelves, make four dadoes in each partition. These are easily cut with a dado head if a circular saw is available. It is advisable to make the dadoes a little narrower than the thickness of the shelves, then cut the shelf ends to exact thickness. This is done by placing the upper surface of each shelf against the ripping fence and running the ends over the saw so that the waste is removed on the underside of each shelf. It follows that the height of the dado head over the saw table should not be changed. In this way perfectly fitting joints are assured.

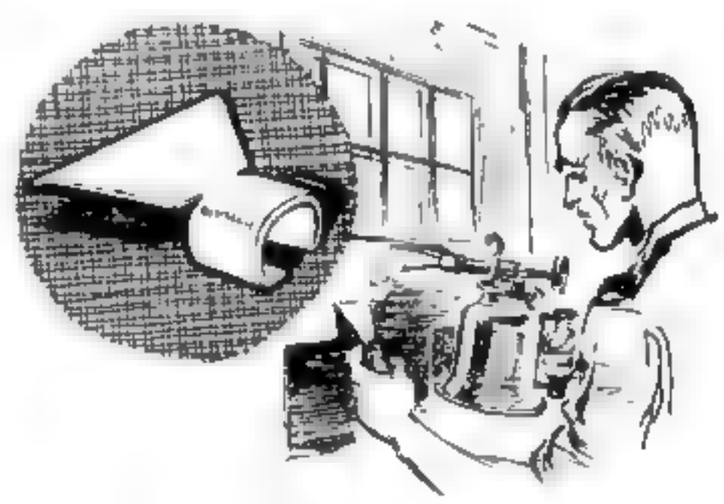
Glue together the main parts; screw two pieces of ⅜-in. plywood backing to the rear edge of the outer partitions; then glue the rounded end shelves into their dadoes and screw the plywood back to them.

The lower rails are screwed to the lower shelves and the back. Strips ¼ by 1¼ in. are glued to the front edges of the partitions, thus covering the dado joints. The top may be fastened with ¾-in. square cleats screwed to the inner sides of the partitions.

The bookcase illustrated was made of birch, stained dark brown and finished with three coats of thin shellac. The first two coats were rubbed down with No. 2/0 steel wool, the last with No. 6/0 or 280 waterproof sandpaper and crude oil on a wooden block covered with cloth. A varnish finish, may be used instead.—HERMAN HJORTH.



Top and front views of the case, and details of the dadoed shelves and method of fastening the top. The dimensions are merely suggestive since the piece must fit the window



Mucilage Bottle Moistens Envelopes

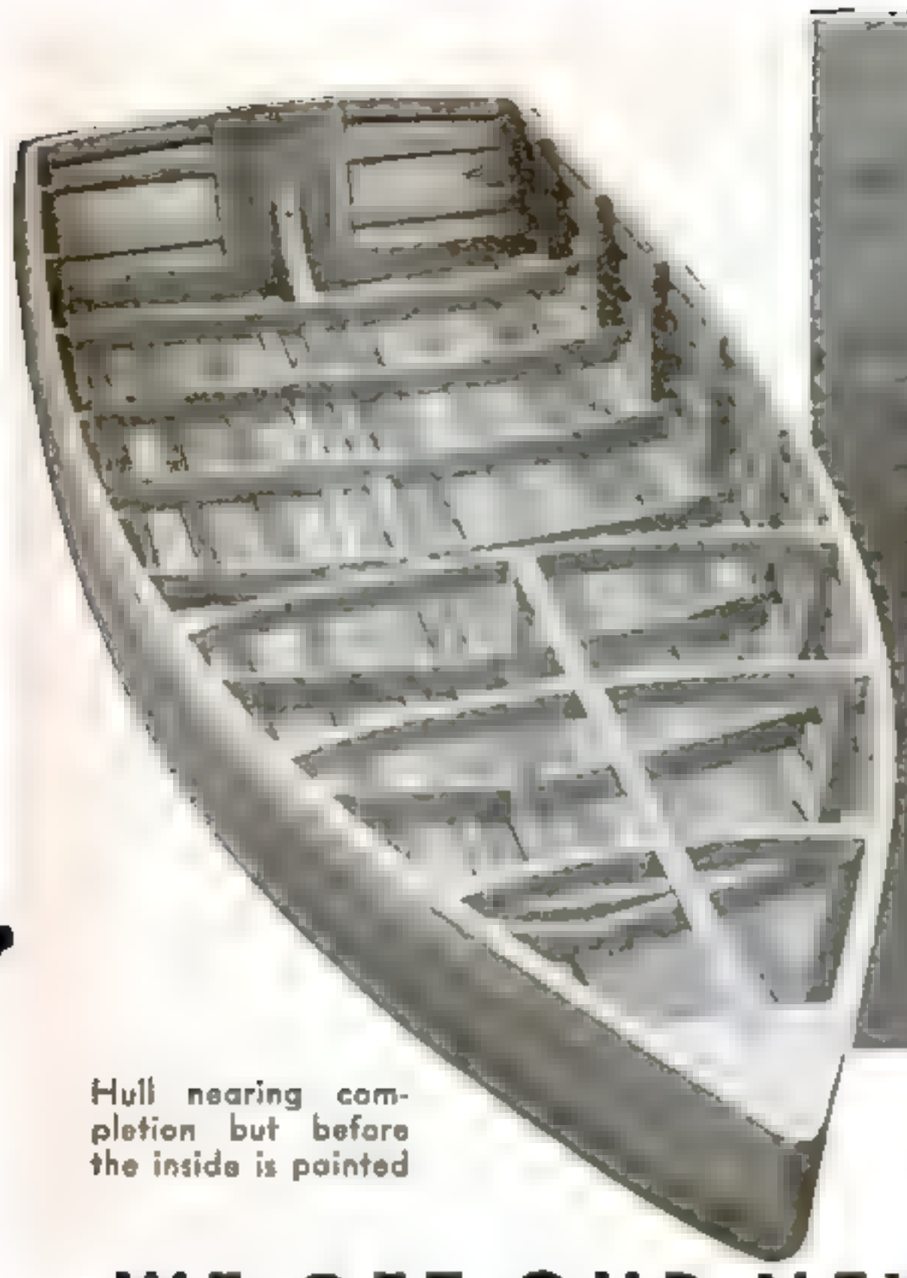
An empty mucilage bottle is filled with water and used as at the right

AN OLD mucilage bottle of the type illustrated at the left, when washed out and filled with water, is a neat and efficient moistener for envelopes and stamps. If the rubber tip is rubbed lightly over the gummed surface as illustrated, just the right amount of water will be applied.—PAUL AMES.

This is the idea of a five-year-old boy and was forwarded on his behalf by his uncle, Charles M. Dorris. Other boys have contributed excellent suggestions to the Home Workshop in the past, but Paul is the youngest contributor of whom we have any record.

Flame Spreader Is Aid in Burning Off Paint

A FLAME spreader made from sheet iron and applied to a blowtorch as shown enables old paint to be burned off with less danger that the concentrated part of the flame will scorch the surface. Paint may also be removed close to window glass or to polished metal or plated fittings.—W. C.

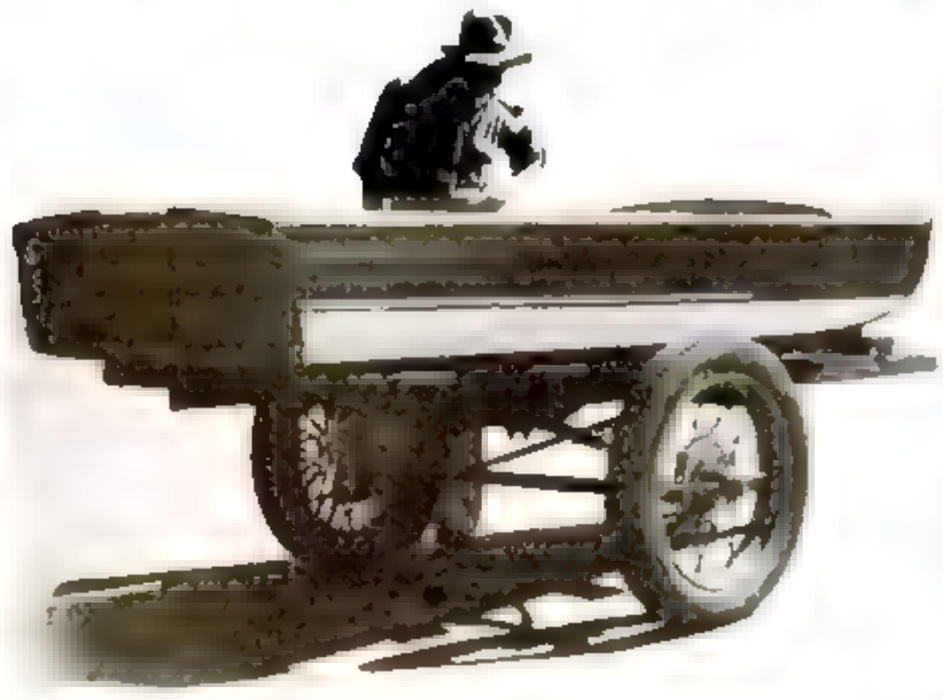


Hull nearing completion but before the inside is painted

Although intended chiefly for use with outboard motors ranging from 3 to 16 horsepower, the boat handles exceptionally well with oars. It is 11 ft. 6 in. in length

WE GET OUR NEW

Fisherman's Boat



IN FITTING the planks of our new fisherman's outboard boat (see P.S.M., June '38, p. 55), it will simplify the work to put in the battens as they are required, rather than all at once.

After each plank is fitted, mark along its edge on the frames for the center line of the batten. Fasten battens to frames with 1-in. No. 7 screws. There will be five bottom planks on each side of the keel. An ordinary pencil compass will come in handy in fitting one plank to the next.

Start with the bottom planks next to the keel—the garboards. They will have to be wrapped in rags and steamed with boiling water at the forward ends. Use 4-in. planks for the garboards; 6-in. can be used for the other bottom planks, and 4-in. widths for the sides. Before these planks are in place, notches should be cut in the frames, next to the keel, so that water can run from one part of the boat to another.

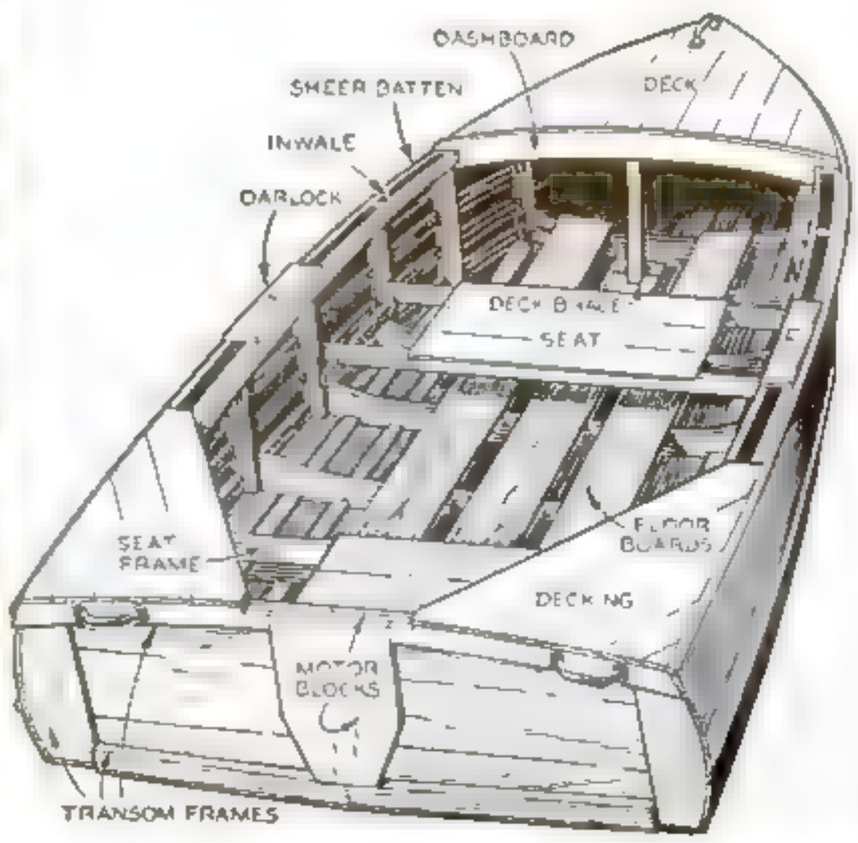
The planks below the water line should be left open about 1/16 in. at the joints to allow for swelling. After the first three planks on each side of the keel are in place, put on the bottom side planks and fit them to the forward ends of these three planks. Then the side planks should be dressed down flush with the chines; the last two bottom planks on each side will merely lap over them.

Just before screwing down each plank, coat with marine glue the battens, transom and transom frames, stem, keel, chines, and all joints that need to be waterproof. Then lay a strip of cotton flannelette over the glued surface and coat the cloth with glue. The battens that cover the bottom transom seam should be made water-tight in this manner. No cloth or marine glue is necessary in seams above the water line.

When fastening a plank, first clamp it in place and then drill holes for the screws. Use a stop on the drill so that all holes will be the right depth. The screws should be countersunk enough to allow for covering later with seam composition or putty.

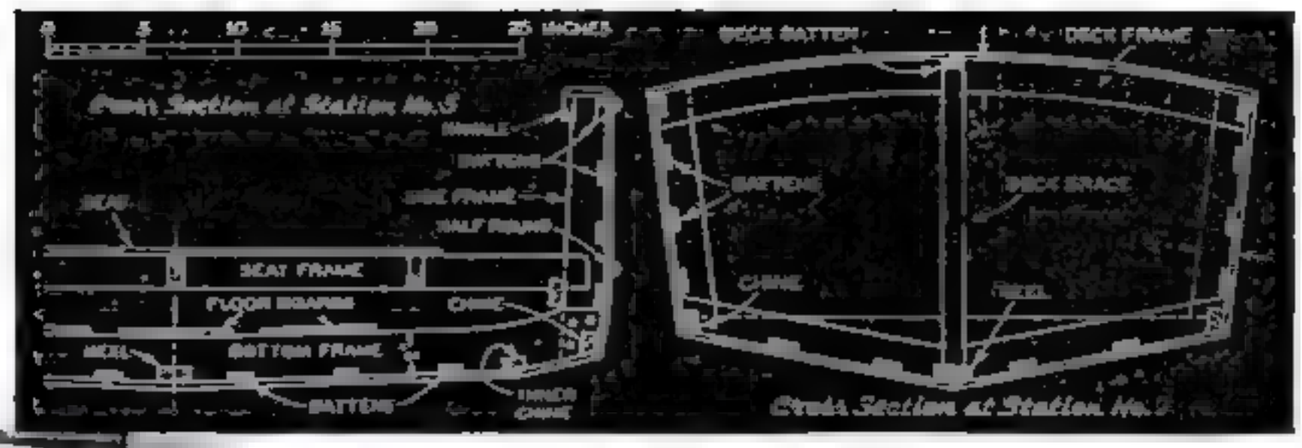
Screw the planks down with flathead screws as follows: (1) Into transom frame, a double row of 1-in. No. 7, spaced not over 1 in. apart; (2) into stem, 1¼-in. No. 8, spaced about 1 in. apart; (3) into keel, chines, inner chines, and frames, 1-in. No. 7, spaced 1½ to 2 in. apart. The planks

The rowing seat may be made removable by notching the seat frame over a cleat screwed to the side frames. Right, a stern view of the completed boat



July 1938

The planking is started with the planks on each side of the keel. Boiling water is used to help in bending them at the forward end



Cross-section drawings at two of the stations. The garboards—planks nearest the keel—are fitted to the stem as illustrated below

Ready to Launch

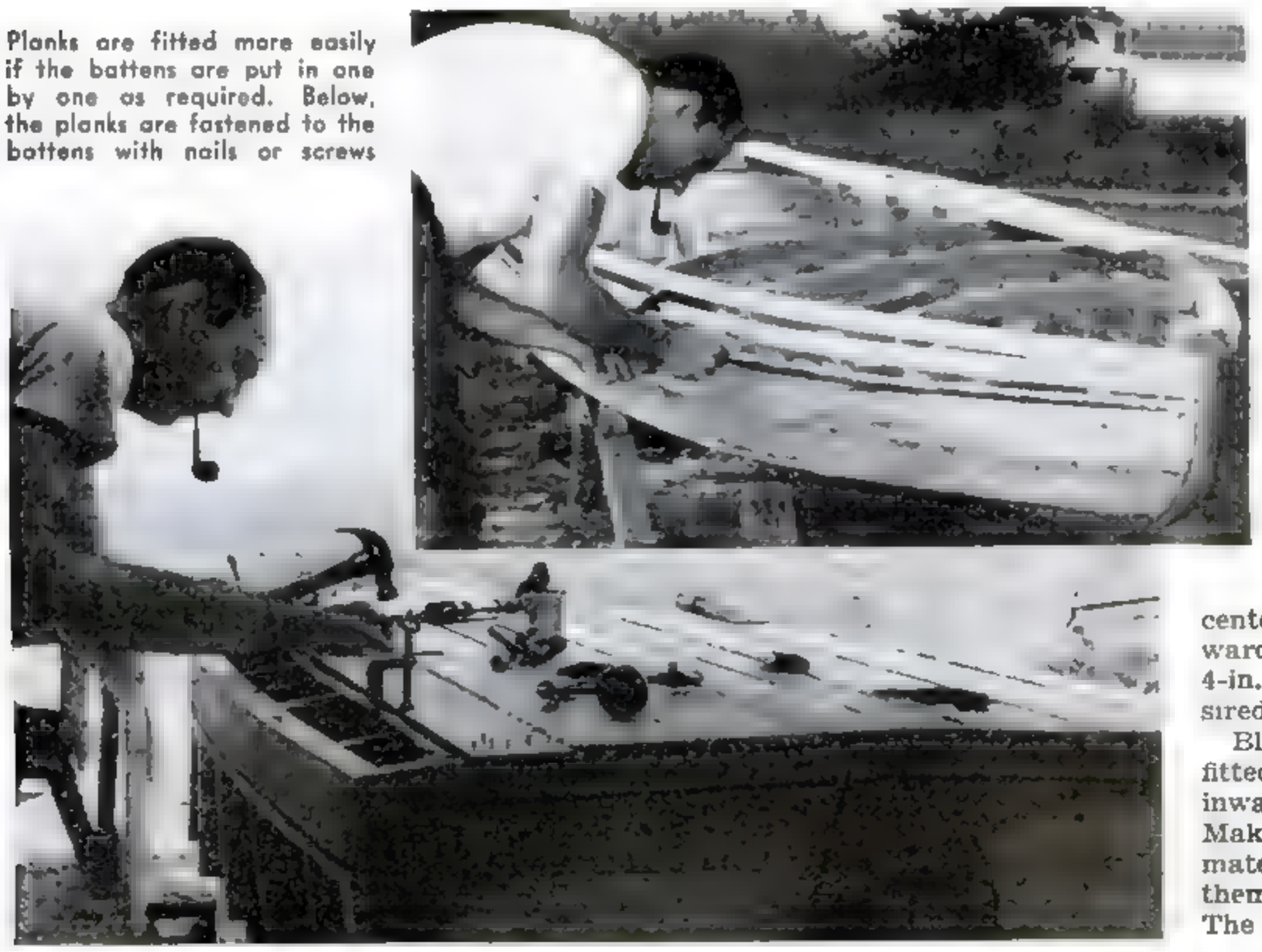
can be fastened to the battens with 1-in. copper or galvanized nails spaced 2 in. apart. Unless very soft wood is used for planking, holes will have to be drilled for the nails. Clinch the nails by first knocking them over from inside with a hammer, then hammering on the head while holding a piece of iron against the nail on the inside of the batten. The planks may be screwed to the battens with ⅞-in. No. 6 screws instead of clinch nails. This is more work, but will make repairs easier in case a plank ever needs to be removed. If screws are used, the battens should be spruce ½ by 1 in.

Before the top side planks are put on, the boat should be removed from the form and set right side up on horses. It will be necessary temporarily to remove the deck frames to do this. The breasthook should be fitted and fastened to the sheer battens before the top planks are put in place. Fasten with 1¾-in. No. 8 and 2-in. No. 10 screws.

After the side planking is finished, the entire inside of the hull should be given a coat of paint. Before starting work on the decking, true up the sheer line, deck beams, and breasthook. Bevel the battens and planking along the sheer line and also the top of the transom so that the decking will fit perfectly. The inwales should be notched slightly into the side frames and fastened with 1¼-in. No. 8 screws. The transom braces should be at least ¾ by 2½ in. and fastened securely to the transom frame and frame No. 7, as shown in the last drawing, with several 2-in. No. 10 screws. Deck battens for the aft decking should be notched into the transom frame and screwed firmly to help brace the transom. Only a center batten is necessary for the forward decking. The decking is laid in 4-in. widths, nailed or screwed as desired.

Blocks to hold the oarlocks should be fitted between the sheer battens and inwales between frames Nos. 5 and 6. Make the seat frames from the same material as the frames, and the seats themselves from left-over planking. The rowing *(Continued on page 91)*

Planks are fitted more easily if the battens are put in one by one as required. Below, the planks are fastened to the battens with nails or screws



Wind-Driven Generator

SUPPLIES ELECTRIC CURRENT FOR A SUMMER HOME

By KENDALL FORD

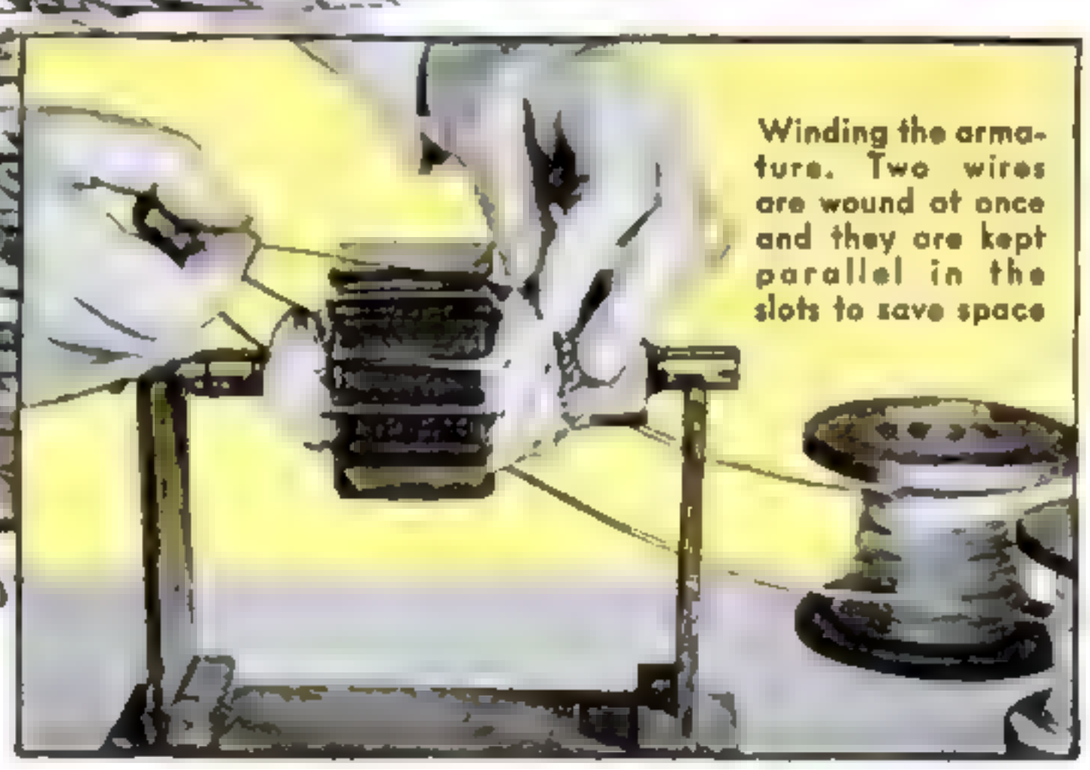
ELECTRIC current for lights and radio in a vacation home may be obtained at a cost that should not exceed ten dollars by building a wind-driven plant from a used automobile generator in good condition and some odds and ends of materials, most of which may be obtained from salvage.

The generator may be geared up for proper speed, but it is much better to rewind it to run at a greatly reduced speed. Practically any type of automobile generator may be adapted, but the outfit described is built around a twenty-eight bar commutator, such as is used on the Ford A, Chevrolet, Plymouth, and Pontiac.

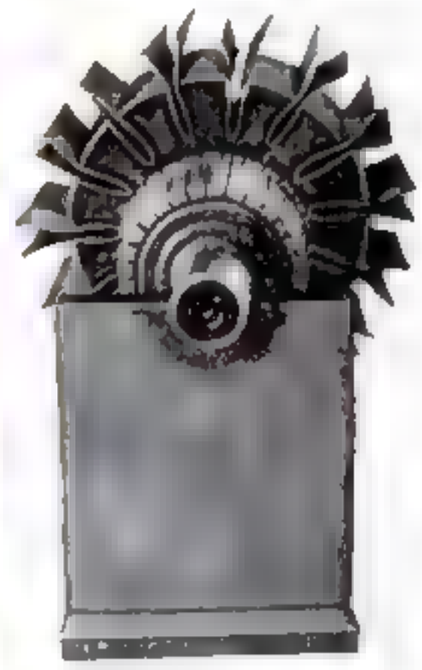
Remove the cut-out coil from the generator, noting which terminal is connected to the generator terminal. Remove armature windings carefully. Note arrangement of original armature coils. Clean slots in commutator bars with a hack-saw blade. Cut fourteen pieces of insulating paper, 2 by 2⅛ in., fold lengthwise, and place one in each slot with the ends extending an equal distance as the winding progresses. The paper may be obtained wherever motors and generators are repaired.

The armature winding requires 1½ lb. of No. 20 celenamel wire. Cotton-enamel may be substituted, but the generator will require a higher speed since fewer turns can be used. In that case, see that each coil is reduced the same number of turns. Number the armature slots from 1 to 14 with a sharp tool, and the corresponding commutator bars from 1 to 28 (Fig. 1).

Divide the wire into two equal amounts, wound on separate spools, as two wires are wound together. Solder two ends of wire in slots 6 and 7 of commutator, place



Winding the armature. Two wires are wound at once and they are kept parallel in the slots to save space



Paper is put in slots as winding progresses. Below, rewound armature

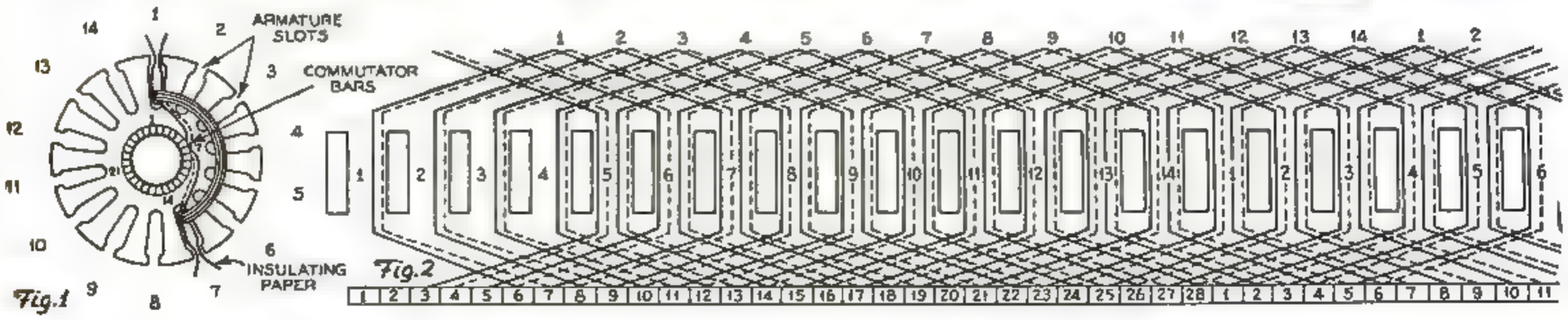


Fig. 1

Fig. 2

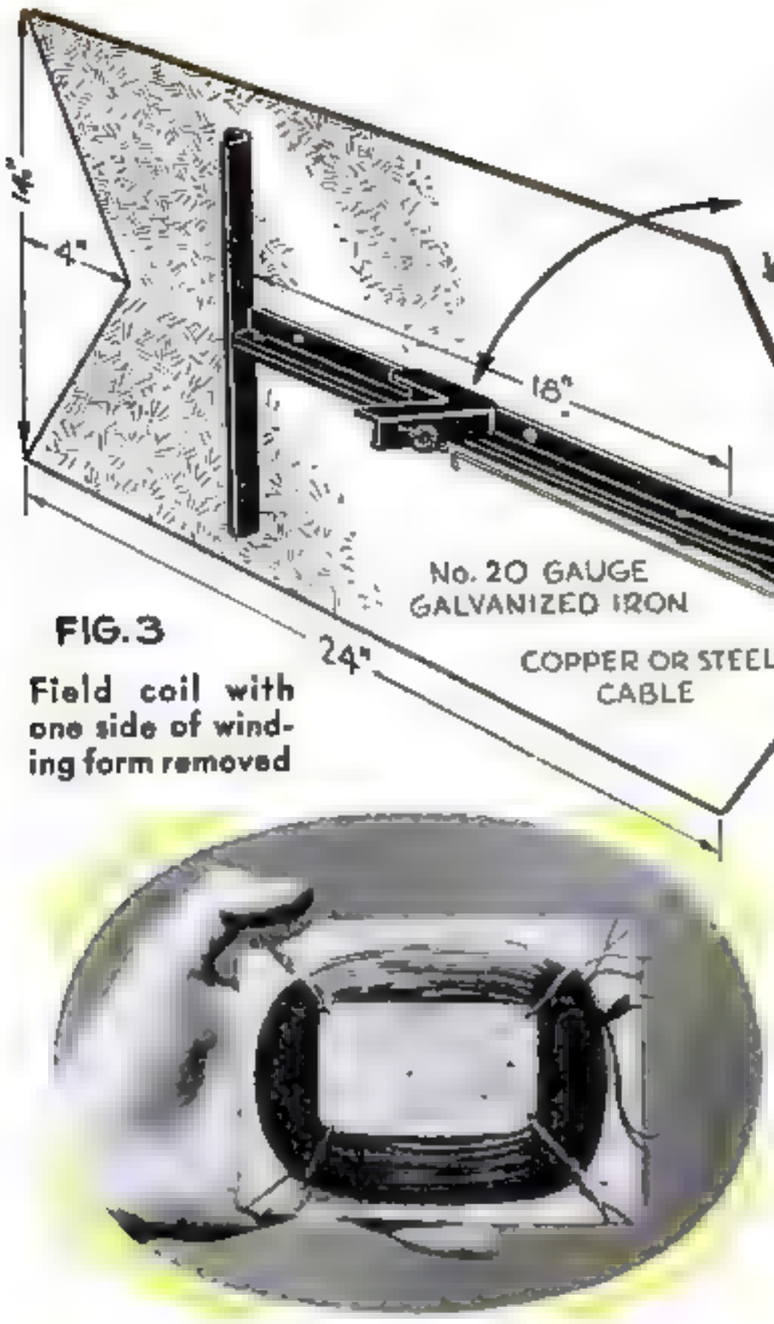


FIG. 3

Field coil with one side of winding form removed

FIG. 4

FIG. 5

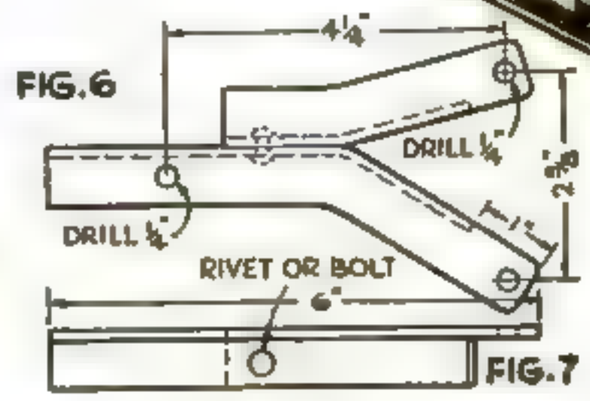


FIG. 6

FIG. 7

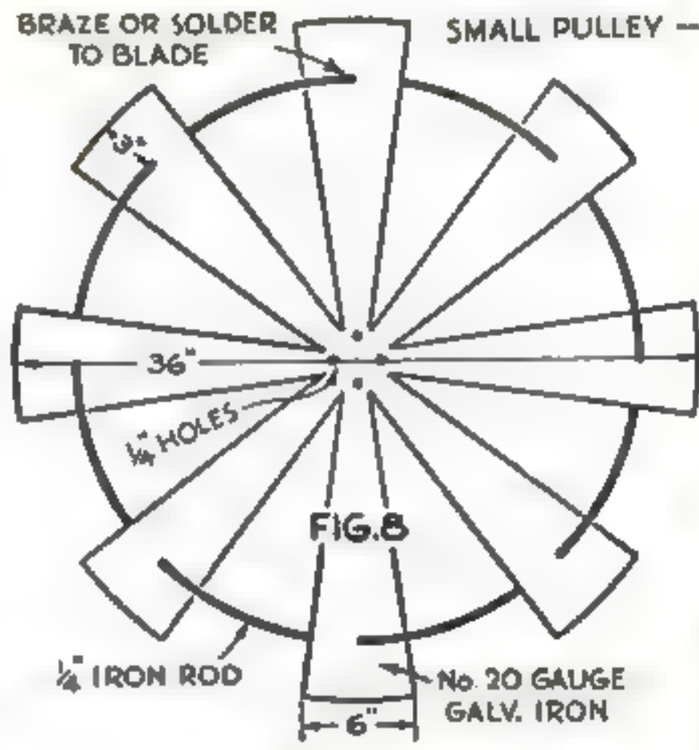


FIG. 8

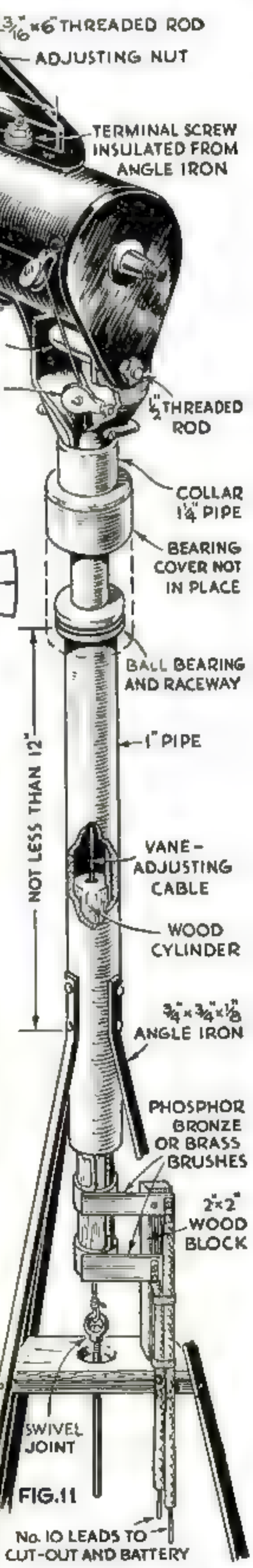


FIG. 11

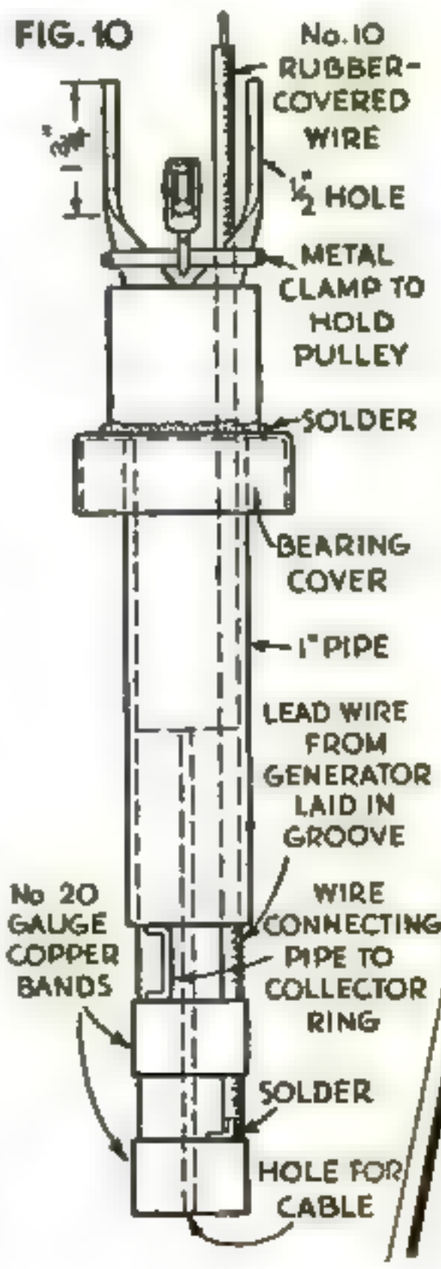


FIG. 10

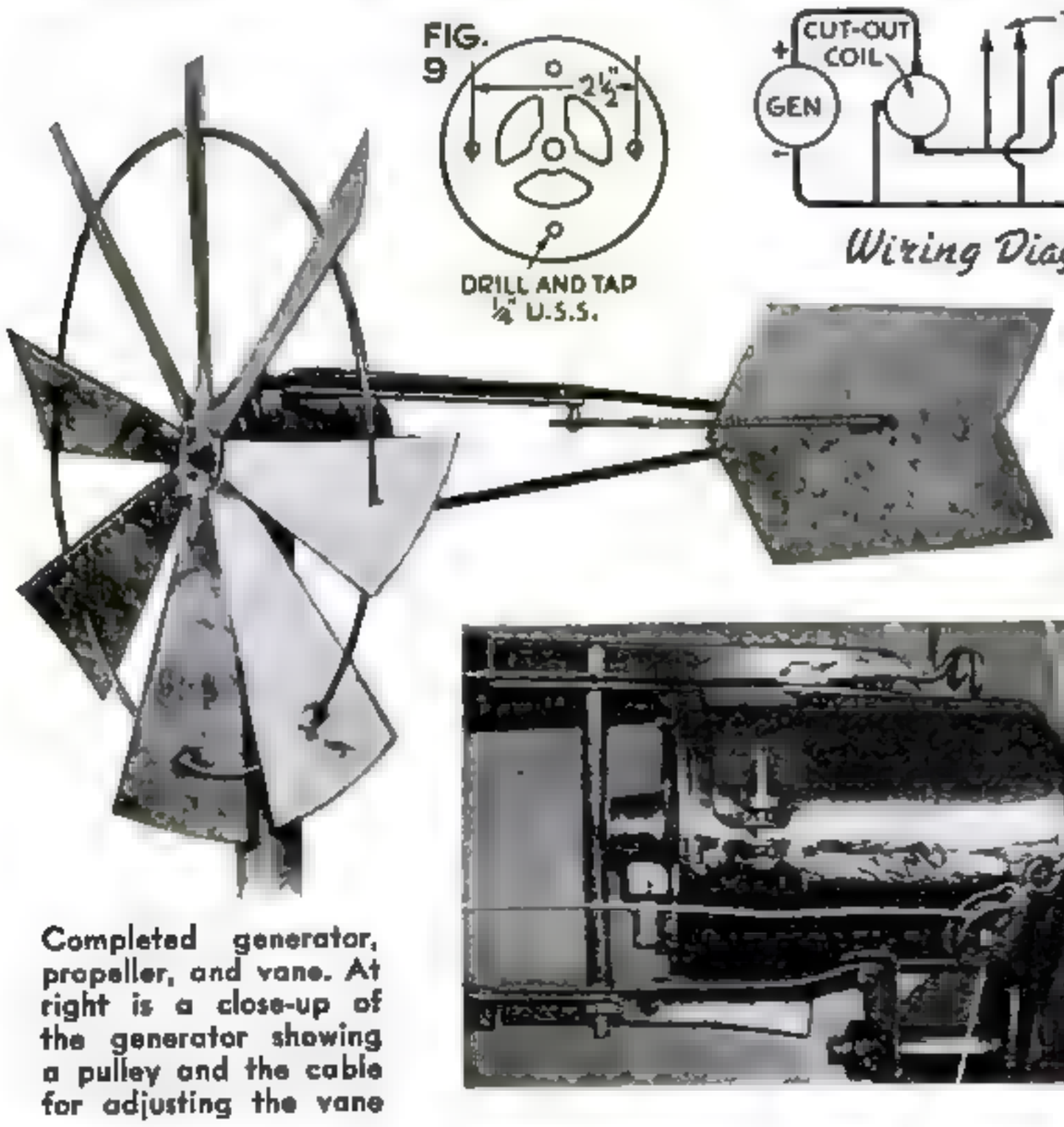
the two wires in armature slot 1, and continue around to armature slot 7, then back through armature slot 1, and continue winding until fourteen double turns have been wound on the armature. Connect the coil ends to commutator bars 7 and 8 (Fig. 2). For clearness, one armature wire is shown as a solid line, the other as a broken line. To save space, all wires in the armature slot should be parallel with each other. Press them in with a flat piece of fiber or wood.

Connect ends of coils to commutator exactly as in Fig. 2, so mark the wires as the coils are being wound, or test the coils with a dry cell and buzzer before they are connected to the commutator.

Continue this procedure until the armature is completely wound. See that the solder does not bridge two sections of the commutator.

Cut the insulation paper off about ⅛ in. above the armature, fold the ends into the armature slot, and hold down with a fiber or wood wedge similar to that used on the original winding.

Paint the *(Continued on page 93)*



Wiring Diagram

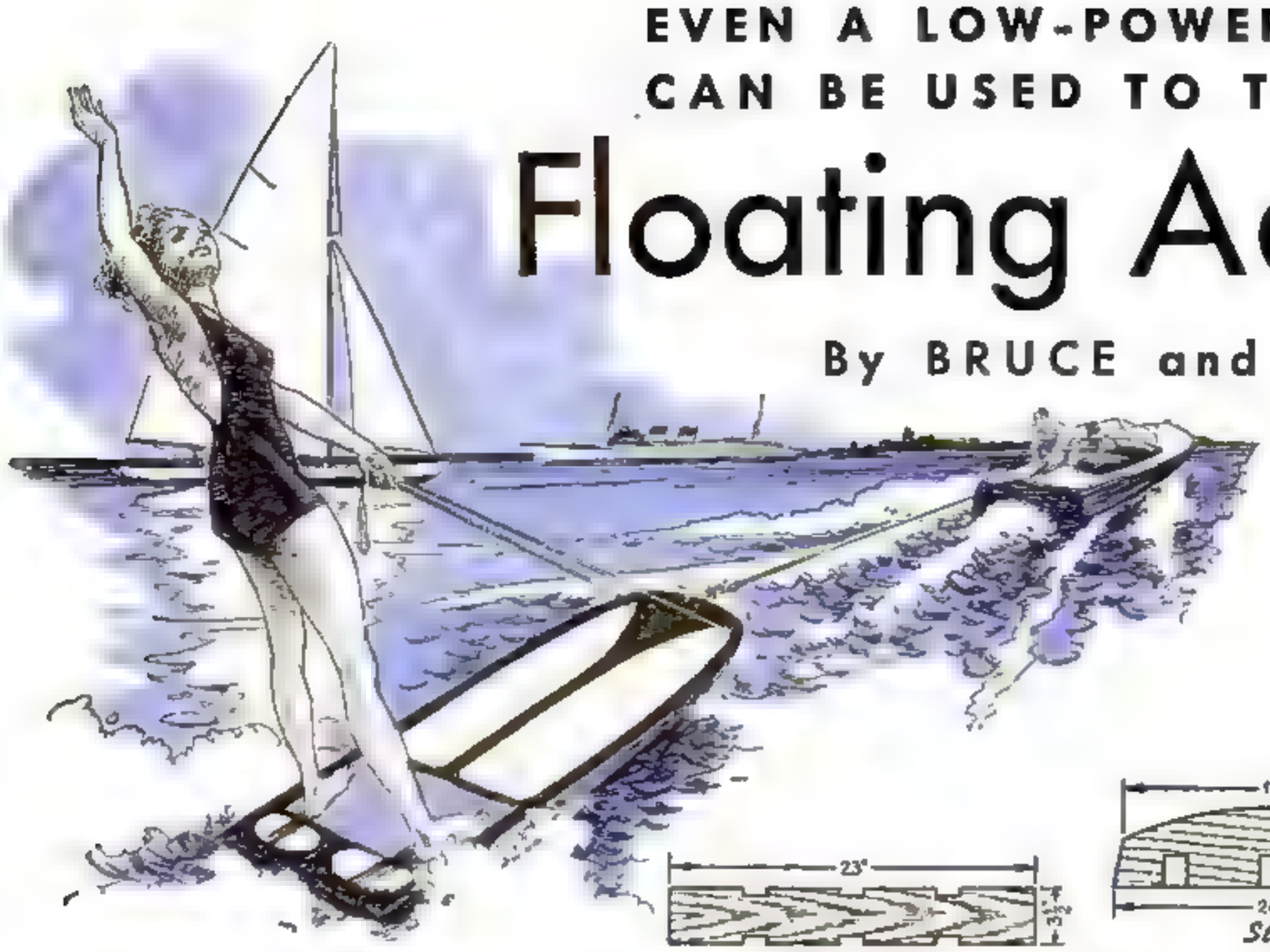
FIG. 12

Completed generator, propeller, and vane. At right is a close-up of the generator showing a pulley and the cable for adjusting the vane

EVEN A LOW-POWERED BOAT CAN BE USED TO TOW THIS

Floating Aquaplane

By BRUCE and WILLARD CRANDALL



Its buoyancy makes this aquaplane easy to mount and ride, and it will never nose-dive

YOU need not own a powerful and expensive speed boat to have good sport with this aquaplane. It floats buoyantly so that even the slowest outboard motor can pull it and give some measure of the thrills of aquaplaning. A floating board of this type is also much easier to mount and handle, and it never nose-dives into the sandy bottom.

If suitable materials are at hand, the board can be built in an afternoon. Here is what you will need:

1 pc. 1¼ by 6 by 21 in. spruce, oak, mahogany, or pine for the stem.

1 pc. ½ by 3½ in. by 14 ft. spruce, oak, mahogany, or pine for the frames.

3 pc. ½ by 1¼ in. by 12 ft. spruce, mahogany, oak, or pine for the battens.

4 pc. ¼ or ⅜ by 6 in. by 12 ft. cedar, mahogany, or cypress for the planking. If, however, the motor to be used is about 15 h.p. or over, it is best to use ⅜-in. rather than ¼-in. planking.

1 pc. ½ by 3½ in. by 12 ft. spruce, mahogany, or oak for the side planks.

2 gross ¾-in. No. 7 brass screws; 6 doz. 1-in. No. 8 brass screws; 1 pt. marine glue.

Cut the stem as shown, tapering it to a wedge shape so that it is ½ in. thick at the bow (front) and the full thickness of 1¼ in. at the back. Make the frames and drill several holes in each to enable any water that may leak in to run through to the last frame. In this frame there is a water-outlet hole, kept plugged when the board is in use. Note that this back frame is made of two ½-in. pieces screwed together.

Build the aquaplane upside down, with the frames and stem laid out on a flat surface 1 ft. apart. The side frames must fit accurately against the stem and last frame. Coat the surfaces with marine glue before fastening them.

Cut notches for the battens in the frames and stem, and screw the battens in place. True up the entire surface so the bottom and top planks will fit perfectly. Screw the planks to the battens, frames, and stem with ¾-in. No. 7 brass screws not more than 2 in. apart. Lay strips of cotton flannelette or similar material, soaked in marine glue, over the joints that must be water-tight. Drill three holes through stem and planking as shown. After painting or varnishing the aquaplane, tack on toweling or rubber matting.

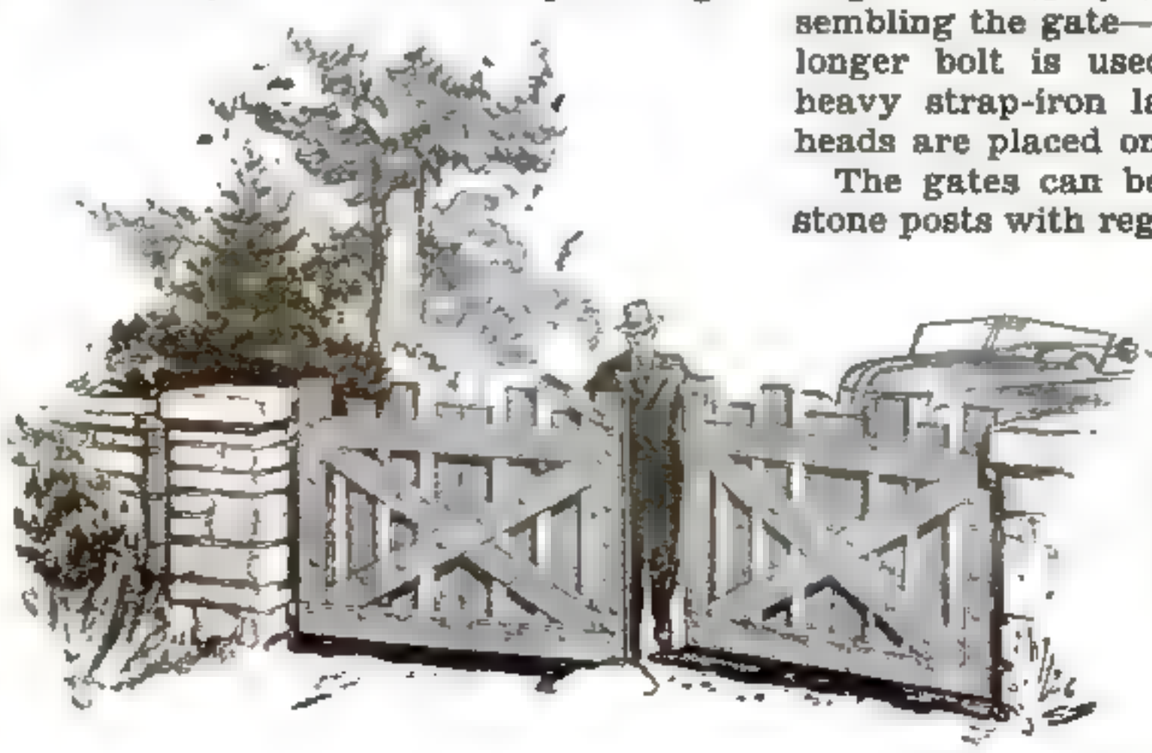
If water-tight—and the secret of that is well-fitting joints and plenty of screws—this board will give excellent service.

A top view of the aquaplane with the planking partly broken away to show the framework, and a sectional side view. Above are the frames and stem. Frame No. 6 is made double thick

Driveway Gate Built of Rough Boards

OF HEAVY stockade design, the gate shown below is substantial and durable. A good type for auto driveways at country homes, estates, and farms, it is made entirely of rough boards 1 in. thick and 6 in. wide, spaced 4 in. apart. The taller boards are 40 in. high; the short ones, 34 in. The end boards are doubled. Roundhead carriage bolts 2½ by ½ in. are used in assembling the gate—123 altogether. One longer bolt is used in attaching the heavy strap-iron latch. All the bolt-heads are placed on the street side.

The gates can be hung on wood or stone posts with regular lag-screw gate hinges. With stone posts the hangers will have to be placed between the stones when the posts are being built. The gates are stained with brown shingle stain or can be painted if so desired.—HAROLD JACKSON.



Aug 1938

Metallic Wall Pictures in Chinese Style

DECORATIVE wall pictures can be fashioned with comparative ease from wire and sheet metal. The two illustrated are copies of Chinese originals.

To make the cherry-tree scene, first sketch the drawing full size on paper. Obtain about 4 ft. of heavy steel wire, such as fence wire, about ⅛ in. in diameter. Form this in an 11½-in. circle and solder the ends with a butt joint, where it will later be concealed by the tree trunk. Solder on two small rings of 1/16-in. wire to form lugs as shown, and add the bent wire hanger.

By means of carbon paper, transfer the drawing of the tree (omitting the flowers, flower stems, and bird) to a sheet of copper or tin, which should not be any thicker than 1/32 in. Cut out the silhouette with tinner's shears. Reverse the metal, place it on a block of soft wood, and indent it as indicated with a blunt punch. Then peen the edges with a small hammer over the edge of the wooden block. The smaller limbs may be beveled into a semblance of roundness with a file.

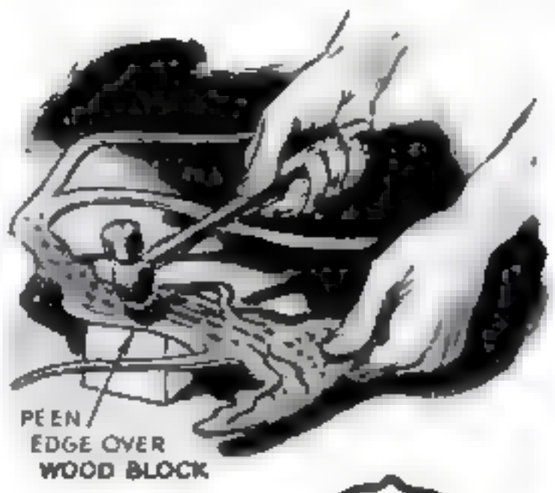
Place the tree within the frame and solder it with butt joints at the two spots where the upper limbs touch the frame. With a small hammer, peen the base of the tree down on the frame, hold it with small clamps, and solder securely from the rear.

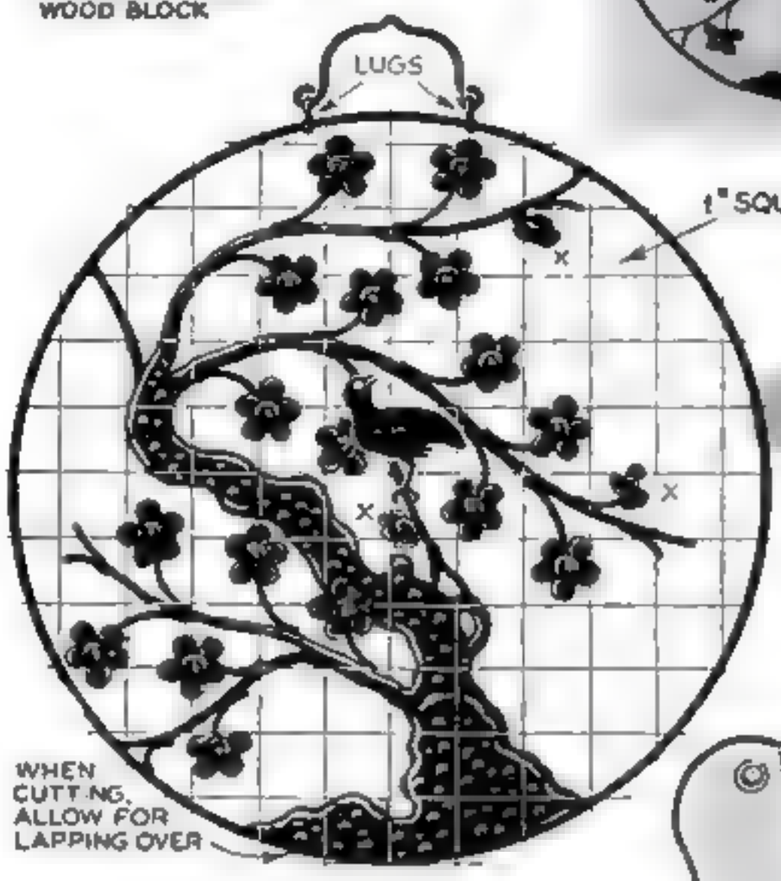
From the scraps of metal remaining, shape and drill or punch twenty pieces for the flowers like *A*, and twenty like *B*. Crimp the petals and centers into a realistic shape over a block of soft wood with the bluntly convex end of a ⅜-in. round punch. Assemble the flowers with rivets, the heads being uppermost.

Cut short pieces of 1/32-in. wire for the stems and solder them flat on the back of the flowers. Then solder the stem ends to the tree limbs.

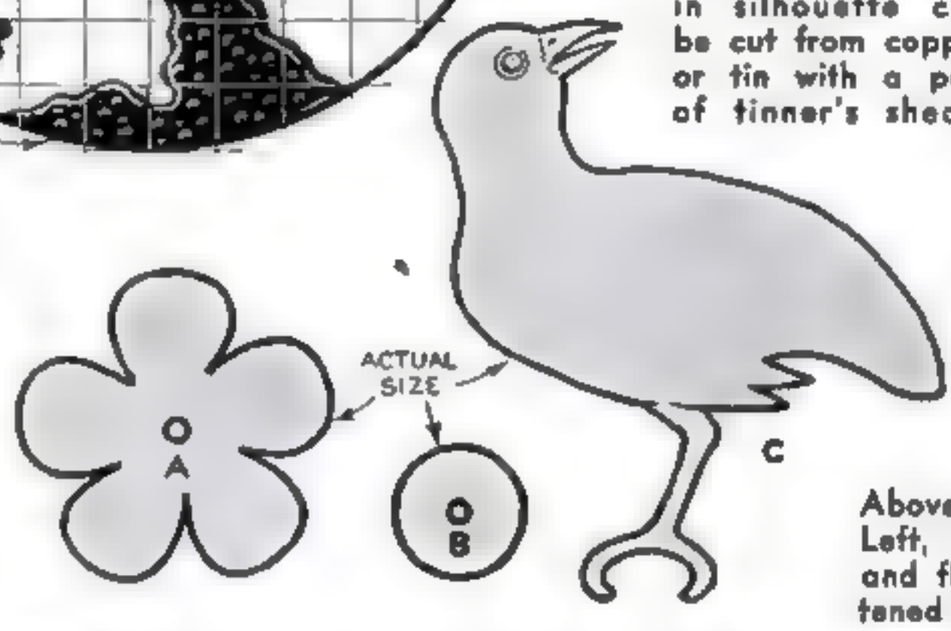
Crimp the flowers marked *X* to represent half-opened buds. Now cut out the bird and solder it in place from the back.

Apply a metallic priming coat and a finishing coat of glossy black enamel. Dry thoroughly before hanging—C. H.



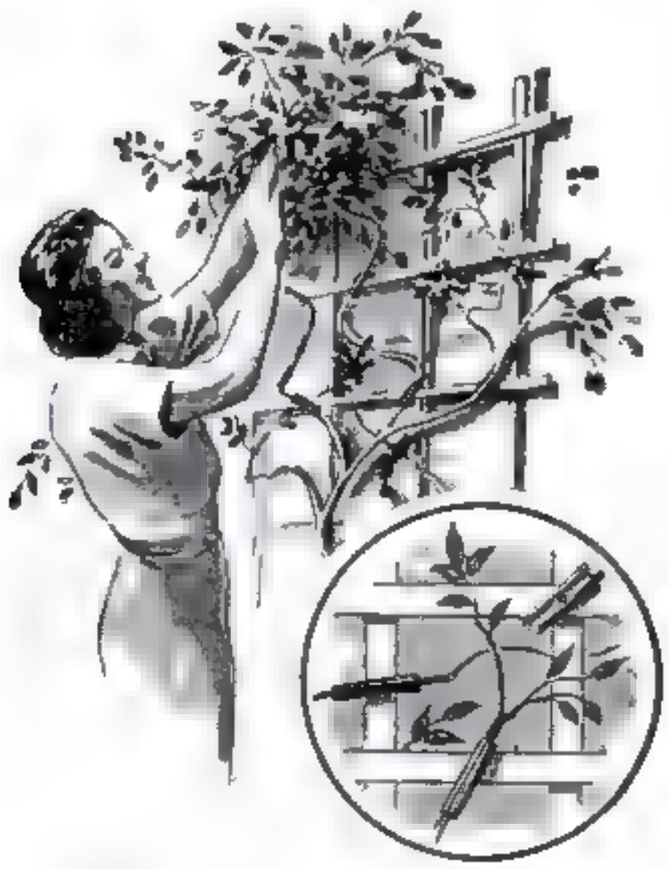


Innumerable designs in silhouette can be cut from copper or tin with a pair of tinner's shears



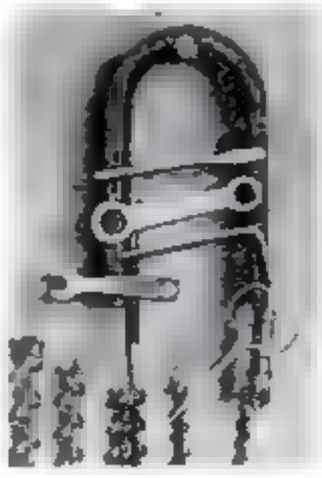
Above, an attractive flower pattern. Left, full-size drawings of the bird and flowers. Parts A and B are fastened with rivets and crimped to shape

Split Pieces of Rubber Hose Train Vines



TO TRAIN a climbing vine on a fixed trellis in such a way that the vine may be removed in the fall for mulching or covering, cut a number of short sections from a length of bath hose, split these along one side and tack them on the trellis as shown. The sections may be opened for inserting the vine, but close around it when released and hold it securely.—G. E. HENDRICKSON.

Large Magnet Holds Tools

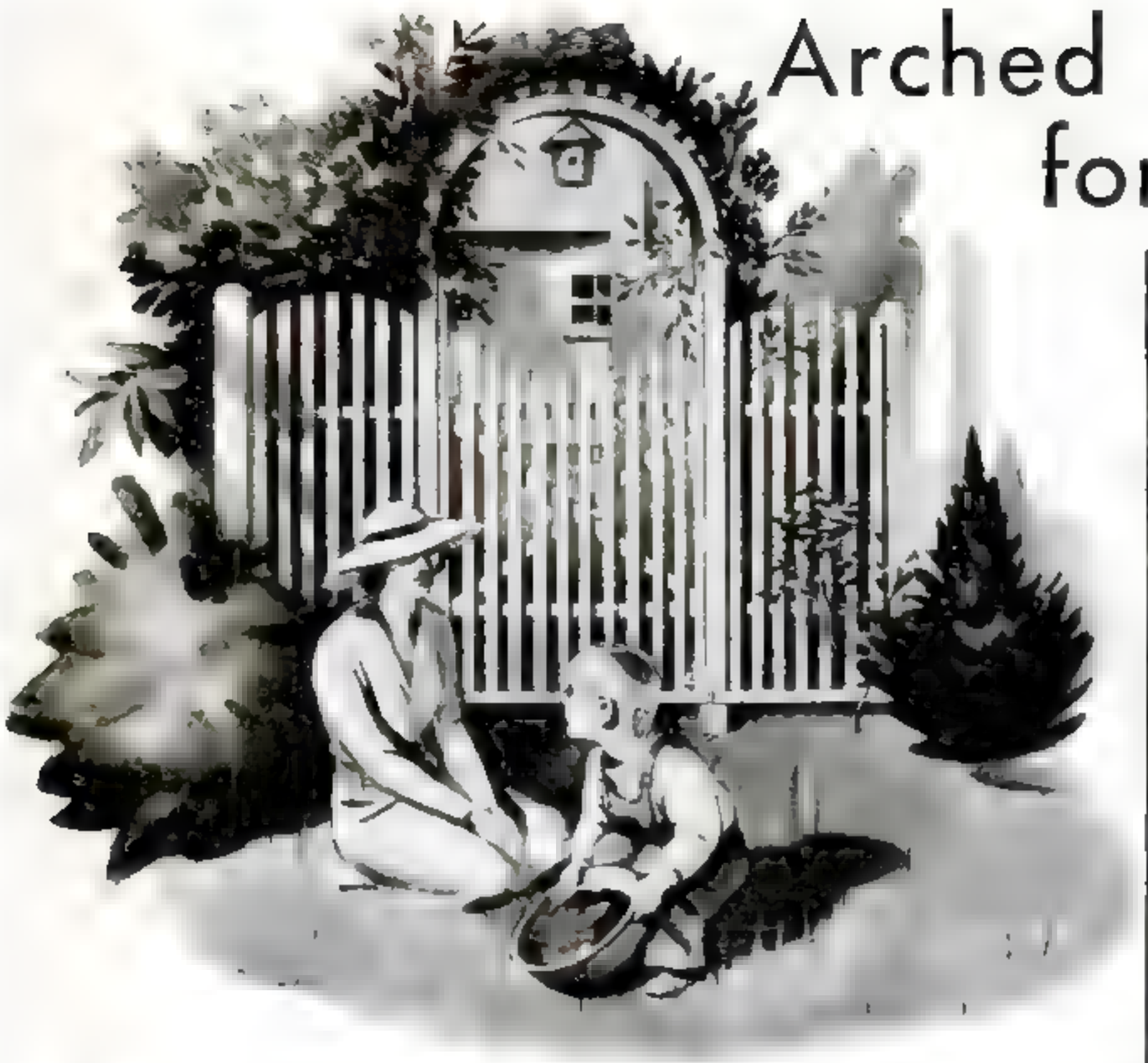


A LARGE, powerful horseshoe magnet mounted over the bench forms a handy holder for small tools. They can be removed and replaced quickly.

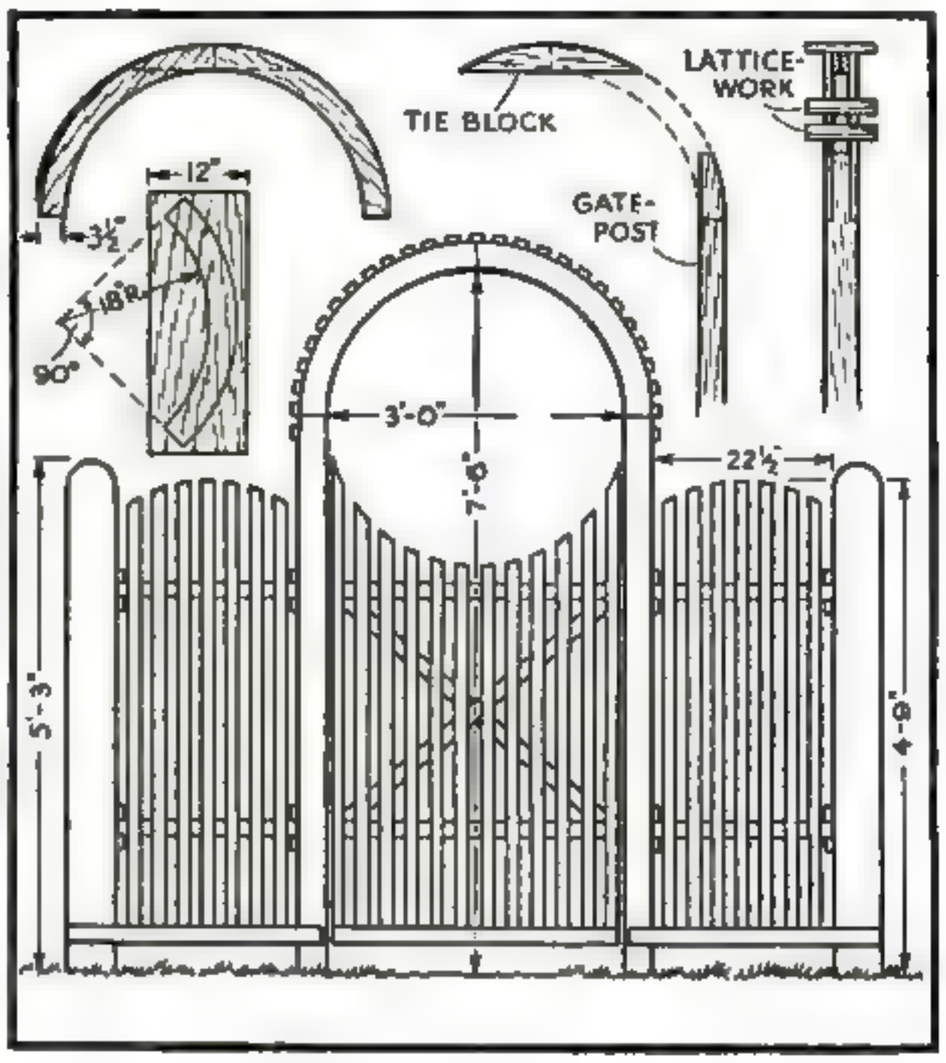
Cleaning Mower Guards

GUARDS on the mower or binder are readily cleaned with the tool shown above. File four or five sawlike teeth in the center of a 20-in. piece of strap iron, and bend the ends up and back. Use the toothed part to clean the nose of the guard, the square ends of the handles for the plates.—NORVAL WRIGHT.

Arched Lattice Gateway for the Garden



Almost any garden or back-yard entrance can be dressed up with this unusually attractive latticework gate. Dimensions may be altered to suit any conditions



THIS latticework gate with side wings can be used at the garden or backyard entrance with pleasing results. White pine, cypress, and redwood are all good weather-resisting woods for such work, and galvanized nails must be used. The gate may be hung with galvanized T-hinges and a latch provided, or it may be nailed in place if the trellis is intended purely for decoration and the gate is not to be used.

The gateposts are 4 by 4 in. and 10 ft. long, although they actually measure about 3½ in. square. They are set in the ground 3 ft. apart on the inside and project 6 ft. 6 in. above the ground level. The tops of the posts are notched at each side to receive the segments of the arch as shown in the drawings, before setting the posts into the ground.

The arch is made of four segments cut from 1 by 12-in. material. Two curved tie blocks are used to join the center of the arch. The lower ends straddle the tops of the gateposts. The 8-in. long lattice crossbars are then nailed around the top of the arch. The arch is completed on the workbench, then lifted to its place and securely nailed from both sides.

The gate and side panels are simple latticework construction. The strips are about ⅝ in. thick and 1½ in. wide, and twenty-six will be needed. Twenty-four are 4 ft. 9 in. long, but the other two, which go at the sides of the gate, must be 6 in. longer. All are spaced 1½ in. apart. The crosspieces are lightly nailed to the shop floor, and the up-and-down strips then nailed to them. One strip is used to do the spacing with, which saves time and a lot of measuring. The cross strips and gate braces are 2 in. wide.

The round opening at the top of the gate is 36 in. in diameter, and the tops of the gate strips are cut to conform to this circle. The wings are rounded off at the top at the same curvature, that is, with an 18-in. radius.

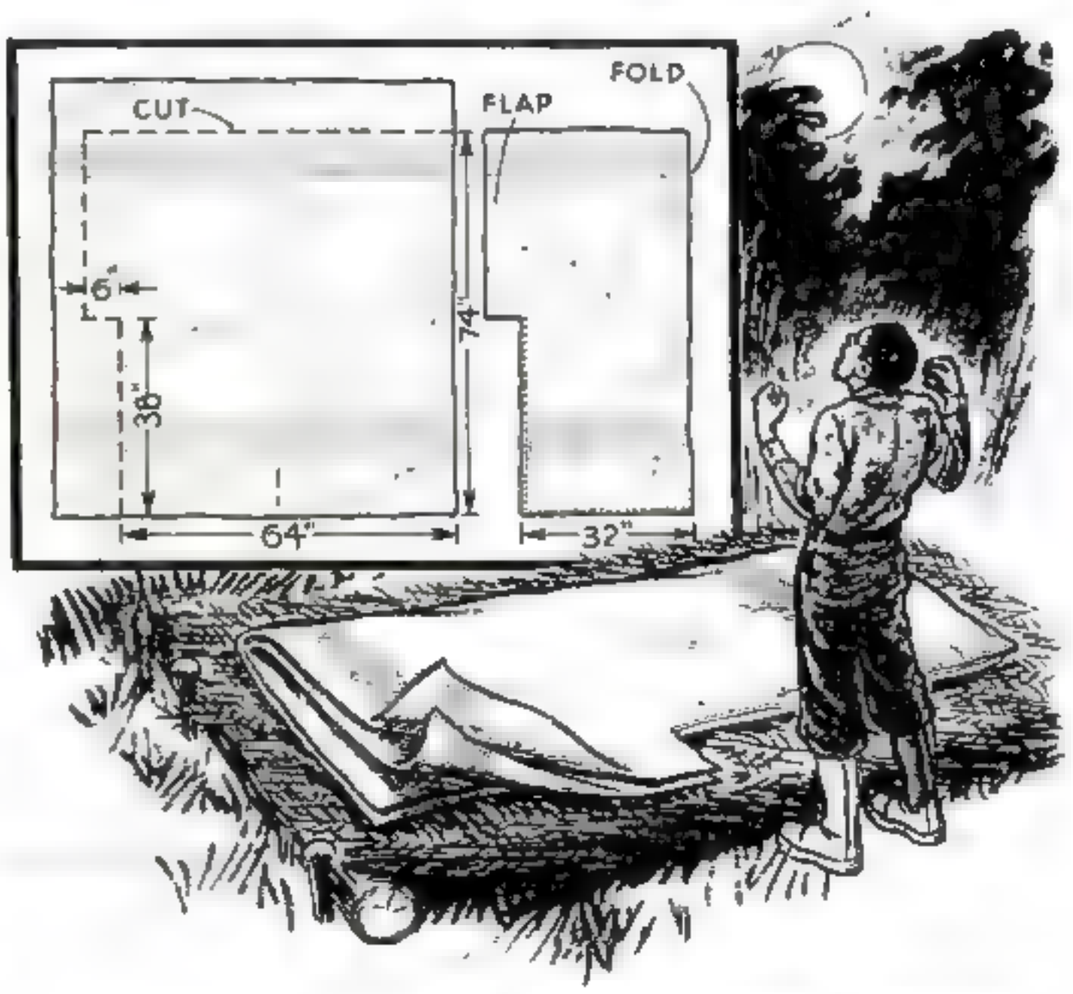
The outer posts are 2 by 6 in. by 9 ft. long and are set 22½ in. out from the gateposts. They project 5 ft. 3 in. above the ground and are rounded off at the top. The side panels are fastened to blocks nailed to the inside of the posts. The front of the latticework is flush with the front of the posts.—H.J.

Seltzer Puts Out Fire

SELTZER bottles, which are inexpensive and can be placed in convenient locations about the home, workshop, or farm buildings, will serve as fire extinguishers. Just squirt the liquid full blast at the base of the fire.—W. W.

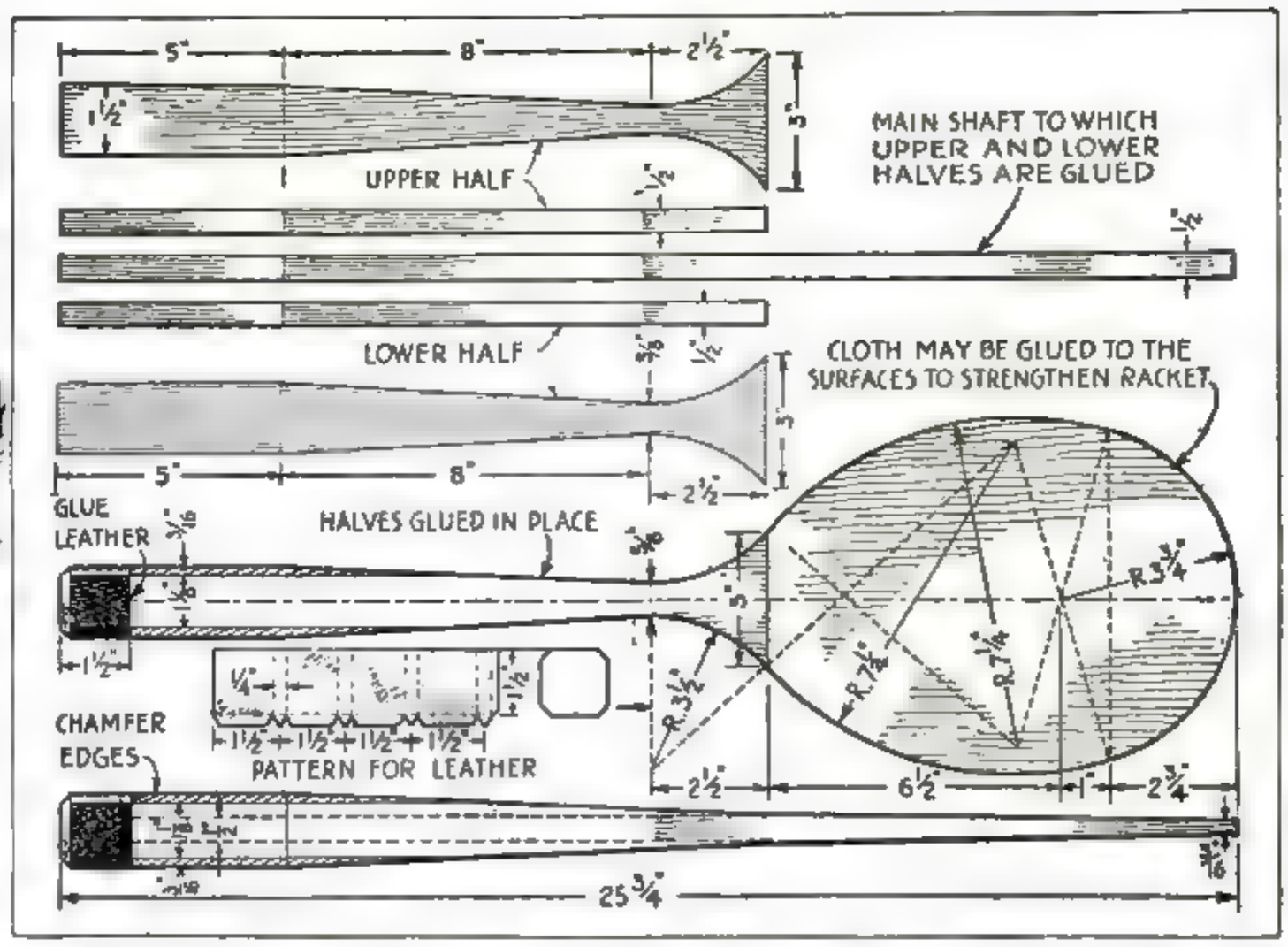
Camp Blankets Made into Sleeping Bag

TWO single 4-lb. blankets, if cut as shown and sewed into a double bag, provide a lightweight, economical camp bed. The outside blanket should be of hard-woven fabric to stand wear; the inner blanket, loosely woven and very soft for warmth. In sewing, whip the edges with an over-and-over stitch. Have the inner bag 1 in. smaller each way. By making the blankets into bags, you discard about 1,100 square inches from each and save about 1½ lb. in pack weight. —MAURICE H. DECKER.



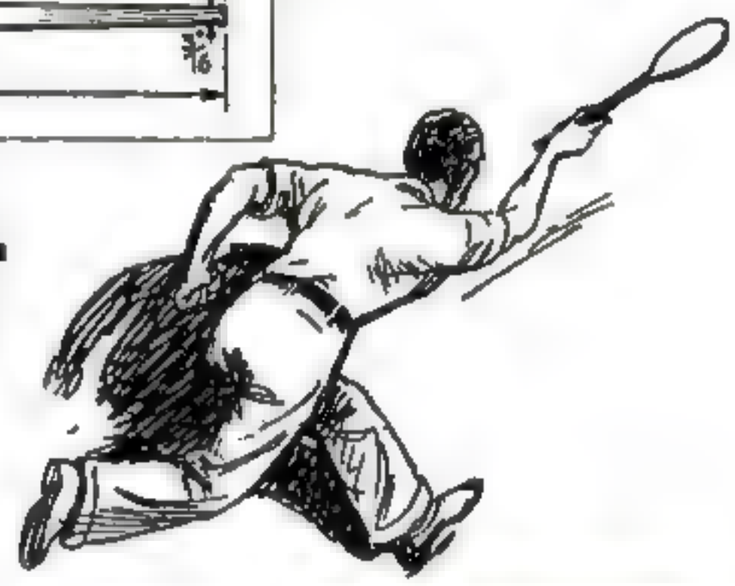
May 1938

Use either plywood or slash-grained wood for the two paddles. Cover the ends of the racket handles with leather



This Badminton Set

COSTS LITTLE TO MAKE



A SUBSTITUTE for a regular badminton racket can be made at a cost of twenty-five cents or less by the method illustrated. The main body can be of ⅛-in. slash-grained wood (the slashed grain to protect against splitting) or from ¼-in. plywood. Care should be taken to balance the racket at the throat in the same manner that a tennis racket is balanced. The end of the handle is finished with leather.

For the shuttlecocks, small two-for-a-nickel, sponge-rubber balls or large five-cent corks will serve. Cut the sponge-rubber balls in half, if they are to be used, and burn eight or more holes around the flat edge at an angle of 45 deg. Cut off most of the quill end of the wing feathers from a chicken and insert the cut ends into the holes as fast as the holes are burned. The softened rubber will help to cement the feather in place. Place the feathers so that their surface is approximately parallel with the curved edge of the ball. Trim off the ends of the feathers to govern the speed; the more feathers, the slower the action. Rubber shuttlecocks are faster than the cork ones.

The cork shuttlecocks are made in the same manner except that the angle is only 15 deg. for the feathers. Glue the feathers in the small end of the cork and grind the large end round on an emery stone.—R. H. JENKINS.

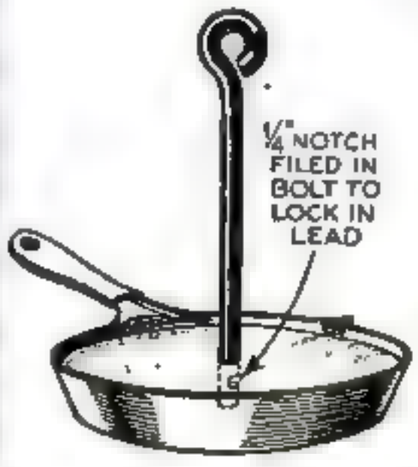
Two methods for making the shuttlecocks. The rubber ones are faster. At right, a completed badminton set

Advertising Thermometer Adapted for Chemicals

SMALL thermometers used on advertising calendars and for similar purposes are sometimes surprisingly accurate. If such a thermometer is cut out and inserted in a small vial, which is fitted with a one-holed cork to receive a glass tube as shown, it will serve for measuring the temperature of liquids used in the laboratory, workshop, and photographic darkroom. Several drops of mercury poured in the vial will make the thermometer respond quickly.

Nonsnagging Boat Anchor

A MUSHROOM anchor for small boats can be made from an 8 by ½-in. galvanized eyebolt, one or two pigs of lead, and a 6-in. frying pan from the ten-cent store. Remove the nut from the bolt, file a ¼-in. notch in the threaded end as shown, stand the bolt in the center of the skillet, and melt the lead in the pan over a hot fire. After the lead has cooled, the anchor may be lifted out of the pan. Its advantages are many: it won't snarl its line, it is small and compact, it works on practically any bottom except smooth rock, and it will not snag on roots or stumps.—J. E. GUY.



Sails for the 'ALABAMA'

IF SAILS are to be set on your model of the Confederate commerce raider *Alabama**, they should be fastened to their yards before the yards themselves are placed—or "crossed," to use the nautical term.

Any opaque material will do for the sails, provided it is quite thin. So-called "balloon cloth" serves nicely. The shape and size of the fore-and-aft sails can be taken from the rigging plan (P.S.M., June '38, p. 74) by making the necessary enlargement of all dimensions. Paper patterns should be made for each sail. Separate plans are given in the accompanying drawings for the square sails and stunsails.

The square sails should be cut slightly oversize to allow them to be bent around the yards to the jackstays and to give a little fullness along the foot. In addition, of course, allowance must be made for the hems.

Rows of stitching at ¼-in. intervals can be run up and down to represent seams. On the fore-and-aft sails these rows will be parallel to the after leeches (edges), and on the square sails, vertical. A narrow hem is sewn all around.

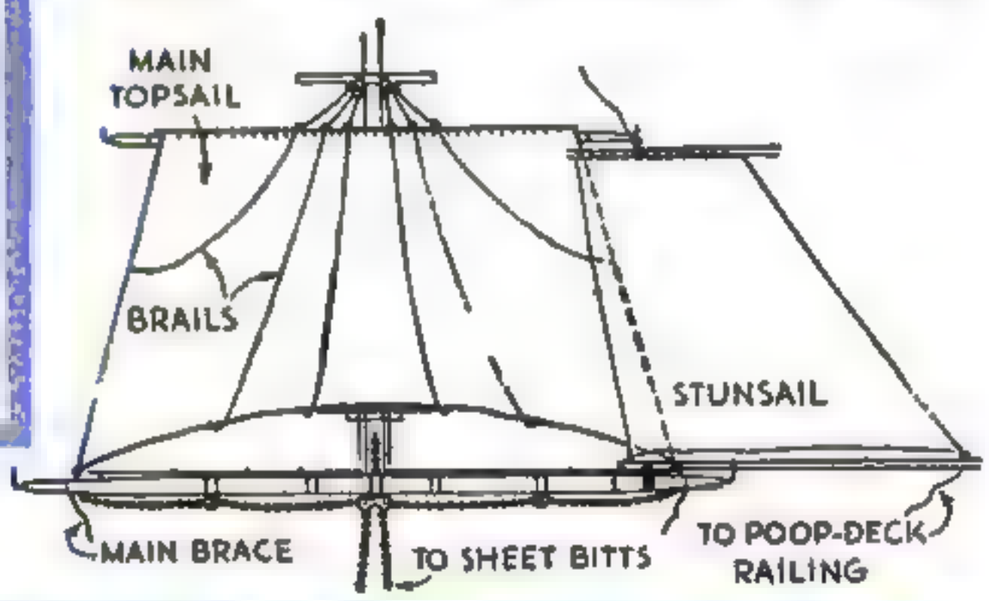
Except along the top edges, a thin brown cord is stitched to the extreme edges. To port on the fore-and-aft sails and abaft on the square sails, loops are formed in these cords at the corners to make clews. Topsails and trysails have rows of reef points stitched on.

Trysails are laced to their gaffs, which are placed in position and held there by the throat and peak halyards (see drawing near end of article). Their forward leeches are stitched to the mast bands at ½-in. intervals. The sheets are single blocks at the clews with cords leading to cleats in the deck. They may have a brail on each side to blocks at the jaws. The vangs

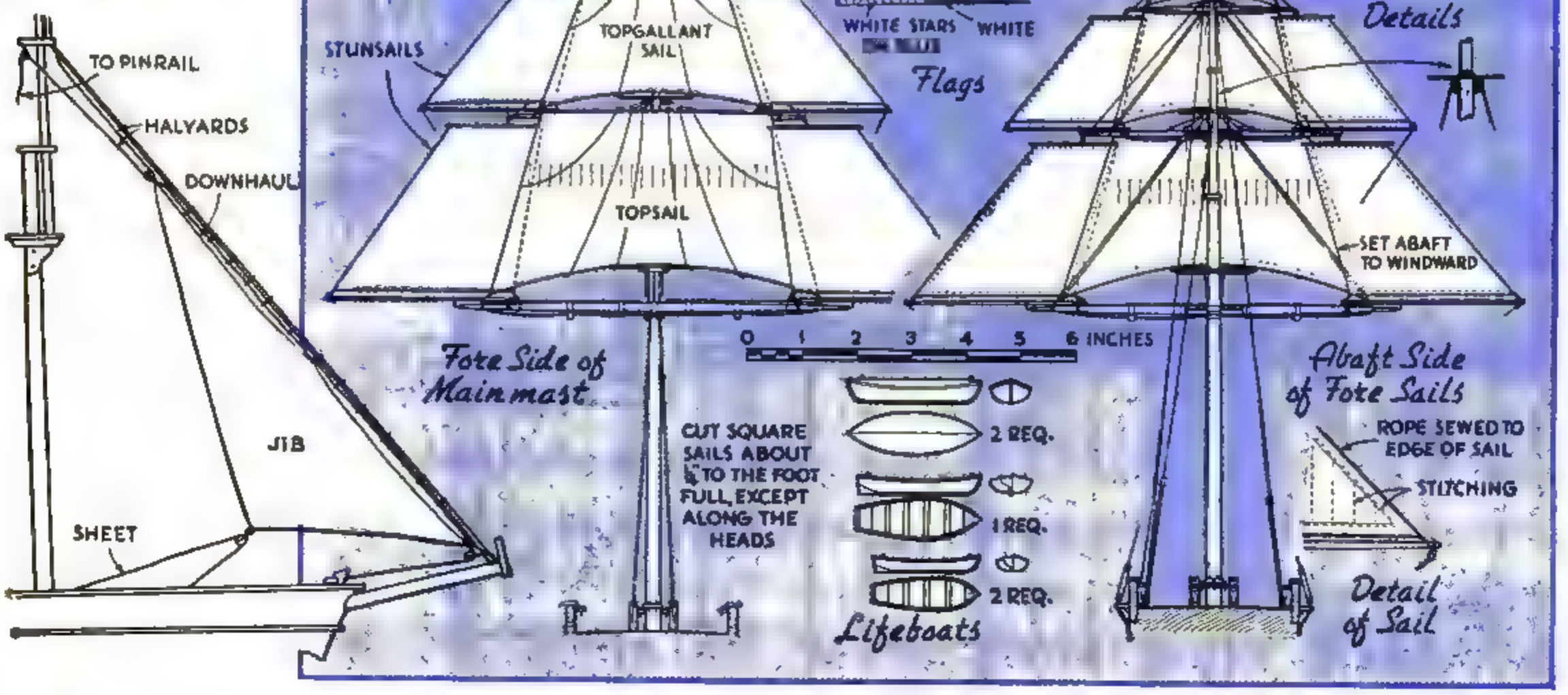
*This series of articles began in the February, 1938, issue.

Main topsail and topgallant sail and their stunsails, looking forward. The forward side of the main topsail and one stunsail is sketched at the right

Two anchors of the iron-stock pattern are required. They may either be bought or made



Square sails, flags, and boats are shown at the right. Below, a jib with essential rigging



By Capt.
E. ARMITAGE
McCANN

The realistic effect of the sails is enhanced by running even rows of stitching up and down to represent seams in the canvas

Try to visualize the "Alabama" as a real ship with sailors aboard; it will help you keep the details properly scaled

go from near the gaff end to cleats in the bulwarks. The original ship had bonnets to these sails, which were cloths laced to their lower edges, but I omitted them on the model.

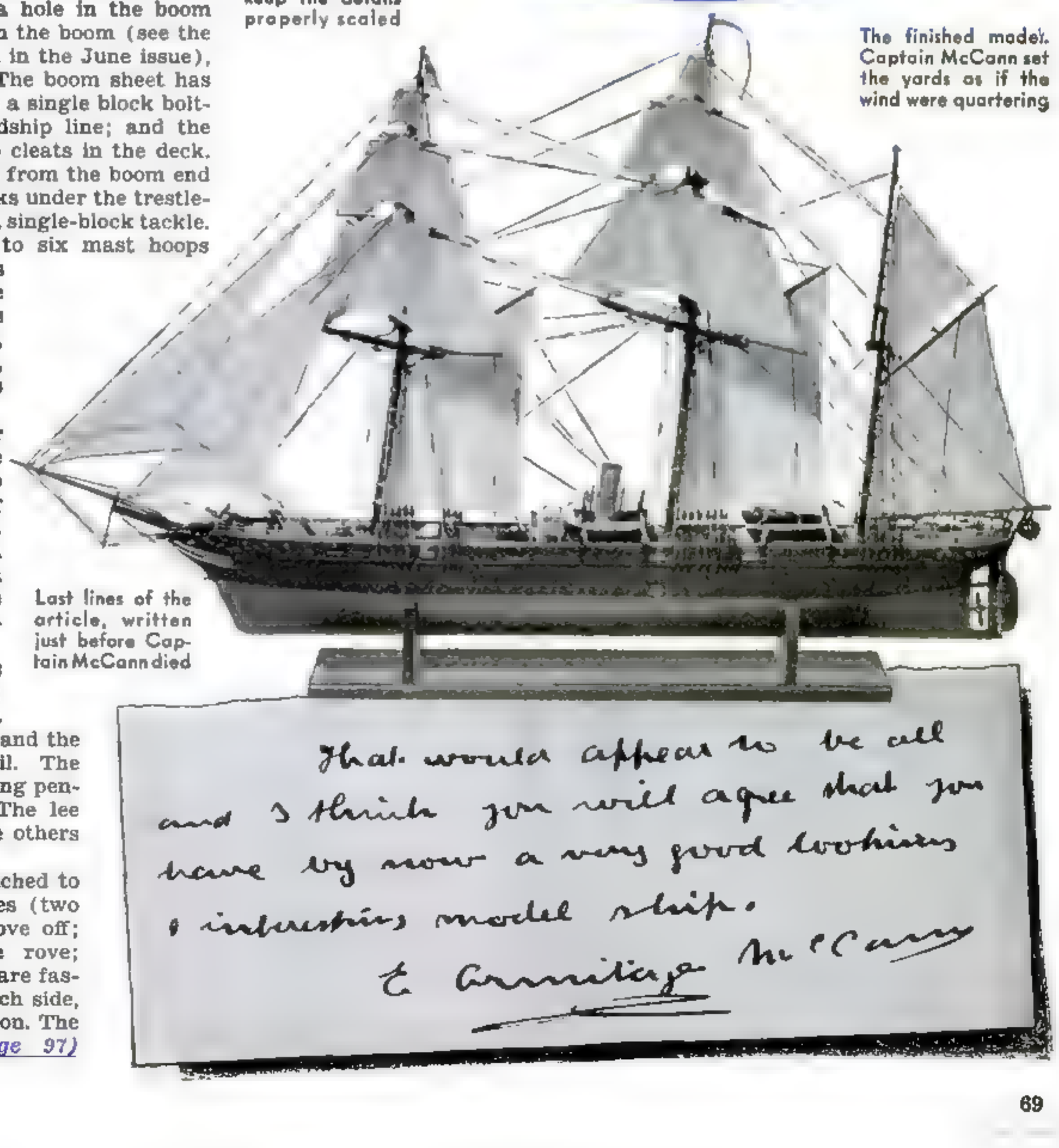
Spanker is similar to the trysails except that the sheet reeves through a hole in the boom end and belays to a cleat on the boom (see the detail drawing of the boom in the June issue), and there are two brails. The boom sheet has a double block, and there is a single block bolted to the deck on the midship line; and the ends of the tackle belay to cleats in the deck. There are also topping lifts from the boom end on either side, through blocks under the trestletrees, and to the deck with a single-block tackle.

Gaff topsail is stitched to six mast hoops about 5/16 in. apart. It has a halyard with two single blocks. The sheet goes through a hole in the gaff, through a block at the jaws, and down. The tack leads down to windward.

Jibs are stitched to their rings on the stays and have two single-block halyards to the mastheads and leading down abaft to the pinrails. The downhauls are thin cords from the head through a block on the stay at the boom, and then to the knighthead belaying pins.

The fore-topsail sheet is a block strapped to the clew; the standing part goes to a ring in the forecastle deck, and the hauling part to the pinrail. The jib sheets are double with long pennants and single blocks. The lee sheets are drawn tight; the others hang slack.

Topsails. The head is hitched to the jackstay. The clew lines (two small single blocks) are rove off; the topgallant sheets are rove; three small blocks or beads are fastened to the jackstay on each side, and the yard is set in position. The chain *(Continued on page 97)*



The finished model. Captain McCann set the yards as if the wind were quartering

Last lines of the article, written just before Captain McCann died

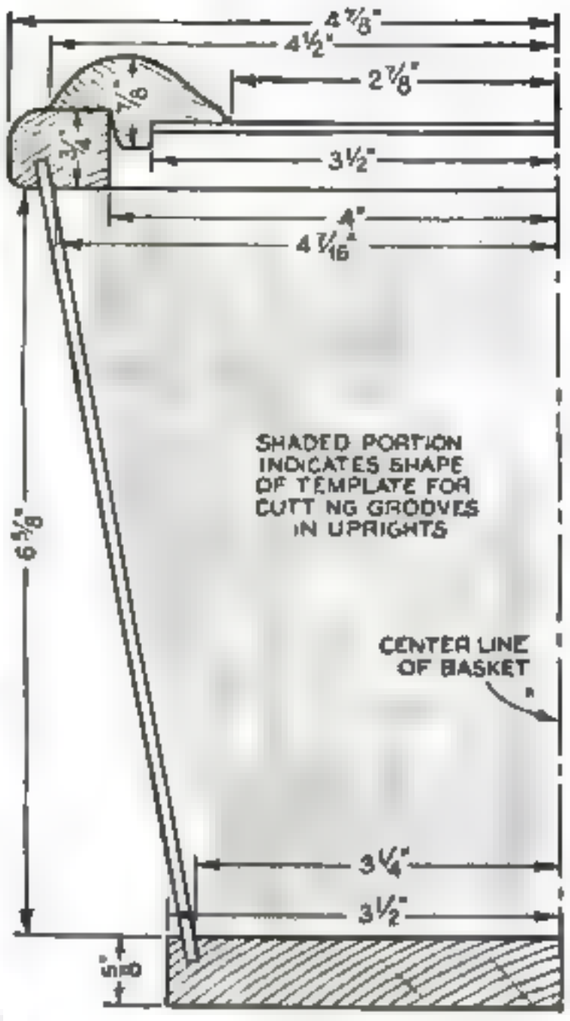
That would appear to be all and I think you will agree that you have by now a very good knowledge of interesting model ship.

E Armitage McCann

Decorative Baskets

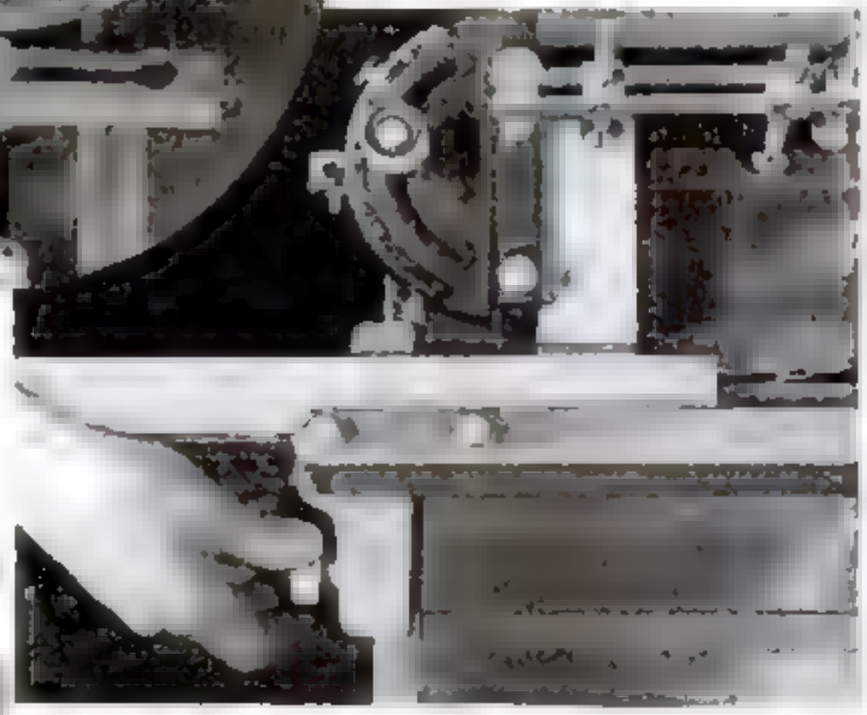
WOVEN FROM THIN WOODEN STRIPS

A sewing basket and cover of white pine. The darker parts are stained, but the weaving strips are natural



Suggested dimensions for a basket. At left, using the template to adjust cutting tool at angle required for making grooves in upper ring

The upper ring of the basket and the bottom disk can be turned from one piece because of the slant of the sides



A piece of wood in the miter gauge is used to adjust thickness of strips when sawing them. Left, the upright strips are set in a grooved block while being cut off to the right length

The upright strips are glued into grooves in the bottom disk. After each weaving strip has been inserted, it is pressed firmly downward as at left

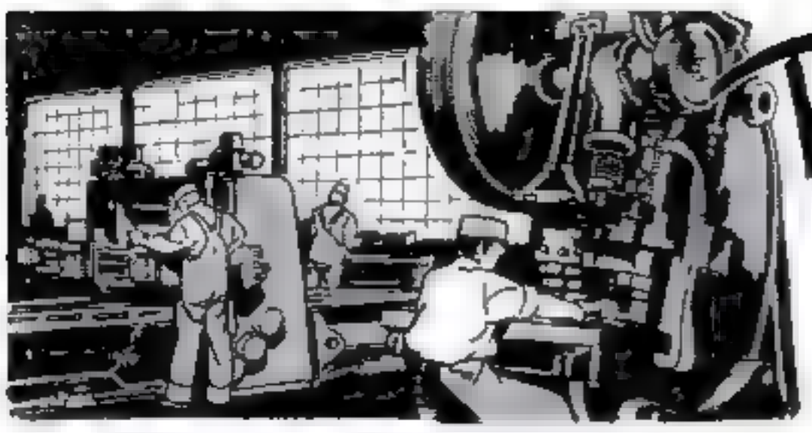
By HOWARD R. HEYDORF

ATTRACTIVE baskets may be woven from wooden strips with little difficulty by any home worker who owns a power saw and a lathe. The finished pieces may be used to hold sewing materials or fruit or for purely decorative purposes.

Although any kind of wood may be used, the writer prefers white pine, which may be stained to produce the contrasting effect. This material is light, easily worked, and unequaled for the weaving strips, which must be very pliable.

The disk for the bottom, the upper ring, and the ring for the top are turned to shape on the lathe. In cutting the grooves for the uprights, a template is needed, the shape of which is shown in the drawing. A small three-cornered file, ground to form a cutting tool, may be used in making the grooves. These turnings are carefully sanded and may be stained if desired.

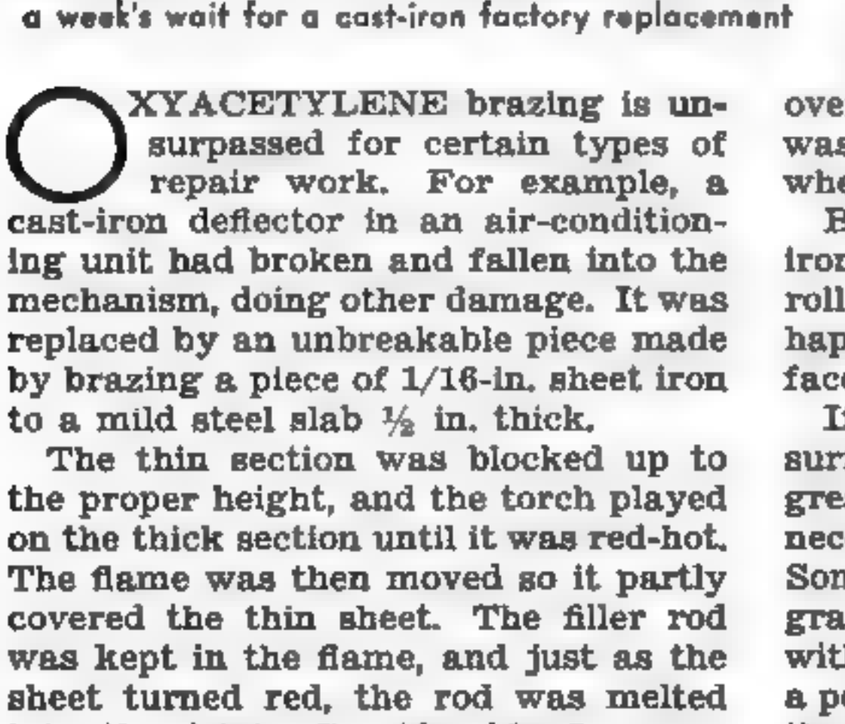
The upright strips are ⅝ in. wide and the thickness of the *(Continued on page 96)*



Better SHOP Methods

Difficult Repairs Made by Brazing

Hopeless as the job looks, it was cheaper to repair this cast-iron cap by brazing rather than form a substitute out of sheet metal. All the broken edges were ground clean and beveled before the work was started



This deflector for an air-conditioning unit saved a week's wait for a cast-iron factory replacement

OXYACETYLENE brazing is unsurpassed for certain types of repair work. For example, a cast-iron deflector in an air-conditioning unit had broken and fallen into the mechanism, doing other damage. It was replaced by an unbreakable piece made by brazing a piece of 1/16-in. sheet iron to a mild steel slab ½ in. thick.

The thin section was blocked up to the proper height, and the torch played on the thick section until it was red-hot. The flame was then moved so it partly covered the thin sheet. The filler rod was kept in the flame, and just as the sheet turned red, the rod was melted into the joint. Considerable flux was used to keep the metal from scaling.

A cast-iron cap broken at the same time was also brazed. The iron around all the breaks was ground clean and smooth, and the edges were beveled to about 45 deg. With the help of some sheet asbestos to support the pieces from the underside, the parts were set in place and then heated until the bright parts of the iron were just changing color. The broken parts were next brought to a dull red, and the flux and rod applied. Since the iron was fine grained and of good quality, the bronze spread over the parts in an even coat. The cap was finally smoothed on a grinding wheel.

Beginners are likely to overheat cast iron, and the bronze will then merely roll around. The only thing to do if this happens is to let it cool, grind the surface clean, and start over.

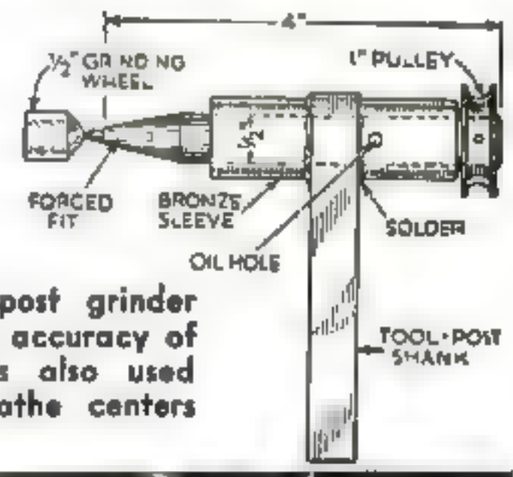
If the brazing is to be done on the surface of the iron and all the dirt and grease have been cleaned off, it is not necessary to grind or chip the surface. Sometimes, when the iron is coarse grained, it helps to peen the surface with many light blows until it takes on a polish. If the iron still refuses to take the bronze, clean it off bright and rub wet blue-vitriol crystals on the part to be brazed. The coating of copper often helps make the bronze adhere to the iron.—W. C. CHENEY.

This is the last of a series of three articles on oxyacetylene brazing.

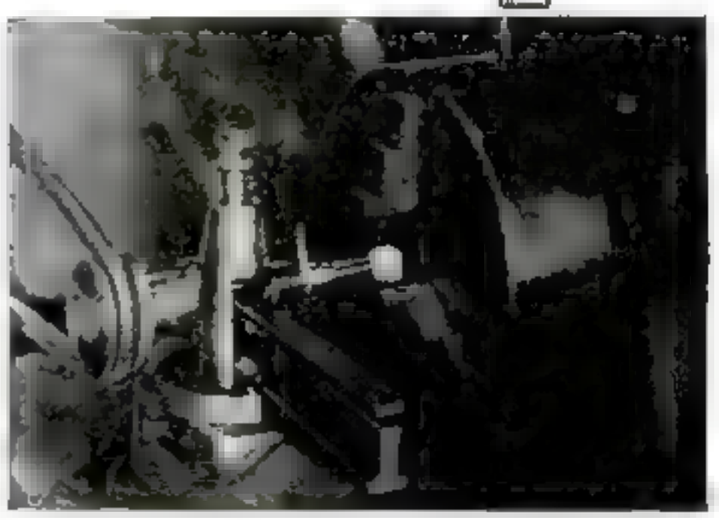
Improvised Grinder Trues Chuck Jaws

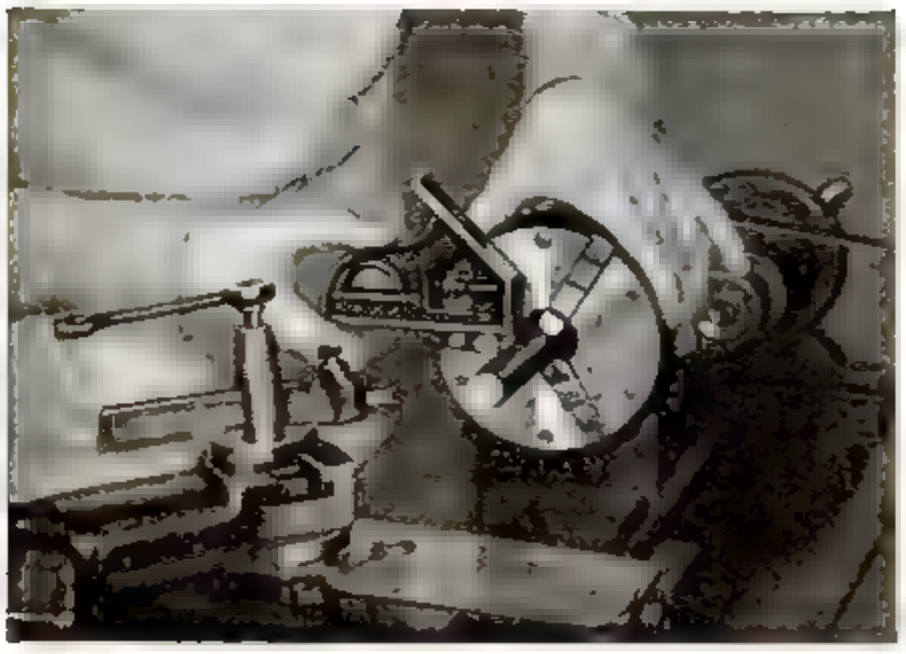
EVENTUALLY the jaws of every three-jawed lathe chuck become so worn as to be unsuitable for really accurate work. To restore their precision, a tool may quickly be improvised as shown below. A small grinding wheel (½ or ¾ in.) with a shank is mounted in the end of a 4-in. shaft made from ½-in. polished shafting. The shaft is fitted in a bronze sleeve about 2 in. long. It may be necessary to run in the bearing with valve-grinding compound. Drill an oil hole, solder the sleeve to a lathe tool shank, and pin a 1-in. pulley to the shaft.

Set up the chuck jaws on a small, thin section of accurately round steel shafting to hold them in position while being ground. The wheel can be driven by a ¼-h.p. motor, and use a long round belt to facilitate the operation. Run the lathe opposite to the direction of the grinding wheel, and move the grinder back and forth inside the jaws, taking light cuts. Then remove the piece of steel in the rear and grind down any projecting part of the jaws that could not be reached before.—W. WALDEMAR.



Simple tool-post grinder for restoring accuracy of chucks. It is also used for truing lathe centers





Three-Jaw Chuck and Level Used for Simple Indexing

WHEN holes have to be drilled through a shaft accurately at right angles to each other, the indexing can be done with a three-jaw lathe chuck and a machinist's level.

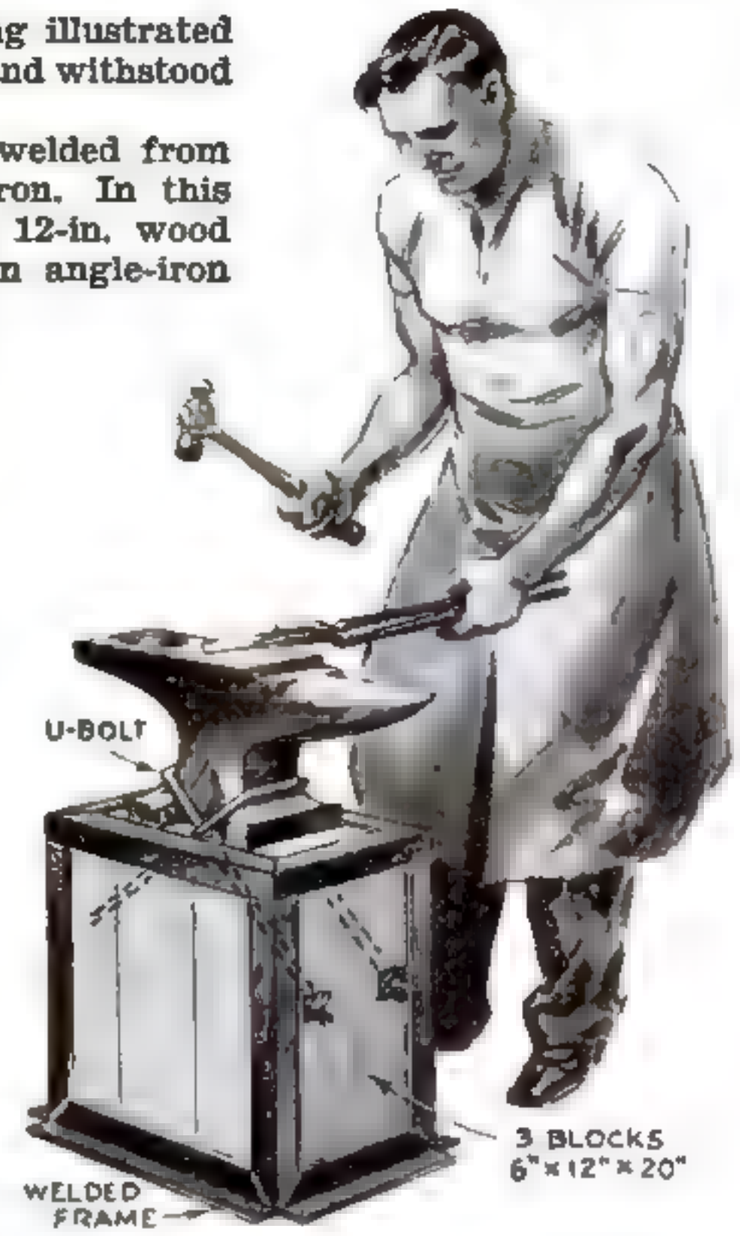
For example, to divide into thirds, chuck jaw No. 1 is leveled at the front of the chuck; No. 2 is also leveled at the front, and then No. 3. In dividing into four, six, eight, or twelve parts, it is necessary to level one or more jaws more than once, the chuck being turned half around and realigned with the aid of the same jaw. The level is used in as many positions as necessary —as a level, as a plumb, or at 45 deg. The scribing may be done with a pointed tool moved along by the carriage.—G. F. LAMPKIN.

Heavy-Duty Mounting for a Shop Anvil

FOR fifteen years the mounting illustrated has supported a 185-lb. anvil and withstood the hardest possible service.

The bottom framework was welded from eight pieces of 1½-in. angle iron. In this frame were placed three 6 by 12-in. wood blocks 20 in. long, ends up. An angle-iron frame was then made to fit over the top of the blocks and, in turn, welded to the four upright angles of the bottom framework. These last welds have been designated by drawing white lines across the angles. In making them, a large tip must be used and the work done quickly; then no serious burning of the wood blocks will result.

The anvil is fastened to the wood blocks with two long ½-in. iron U-bolts. These cross each other and are placed diagonally through the blocks after holes are drilled as indicated by the dotted lines in the drawing at the right. The nuts were kept drawn up tight until the base of the anvil was firmly seated, after which they required no further attention, except for an occasional checking.—W. C.

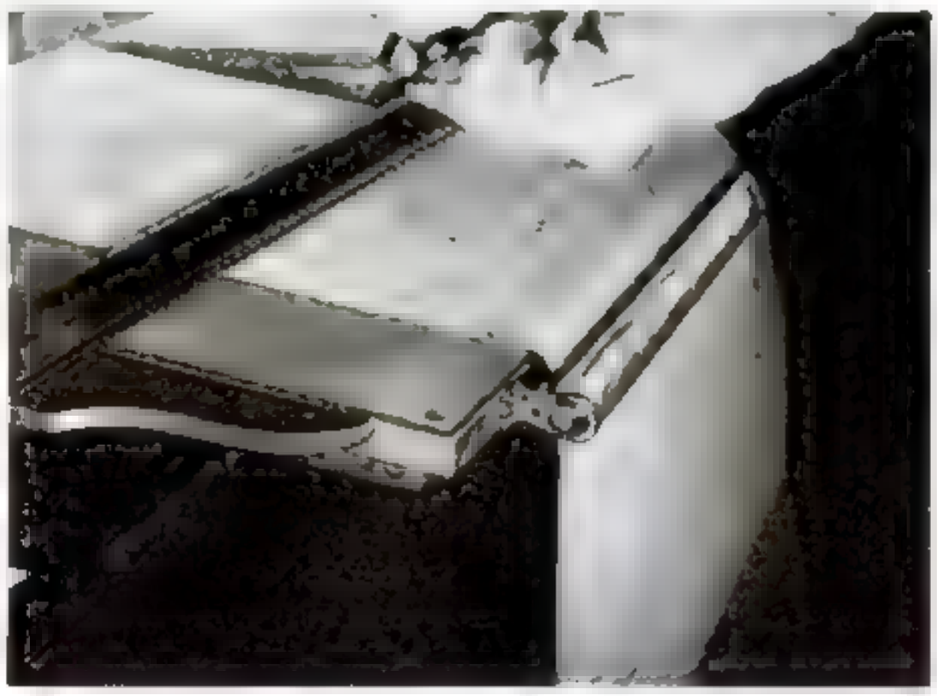


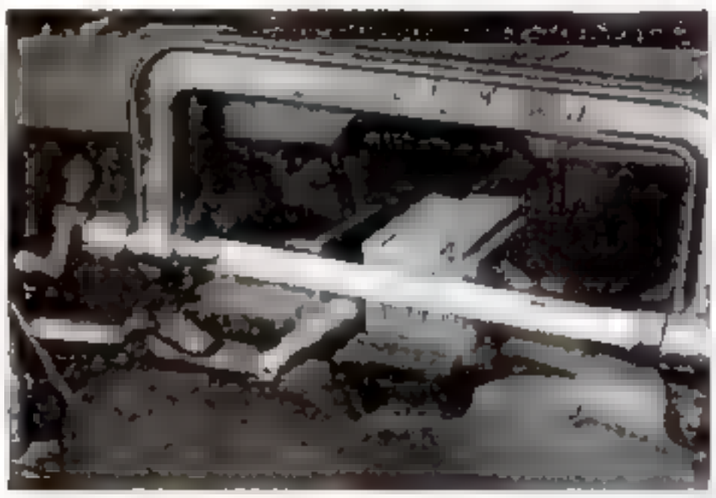
The anvil is supported on heavy blocks of wood set in a welded frame of angle irons

Roller on Drawing Board Saves Back Strain

IF ANY considerable amount of large-scale drafting has to be done, such as is required in the preparation of full-size cabinet or furniture drawings, large shop layouts, and the like, you can save yourself considerable back strain by using the device illustrated. It makes it unnecessary to keep away from the edge of the board to prevent the drawing from being creased. The extra paper is slipped between the 1-in. wooden dowel and the edge of the board, and you can lean comfortably against the rod while drawing.

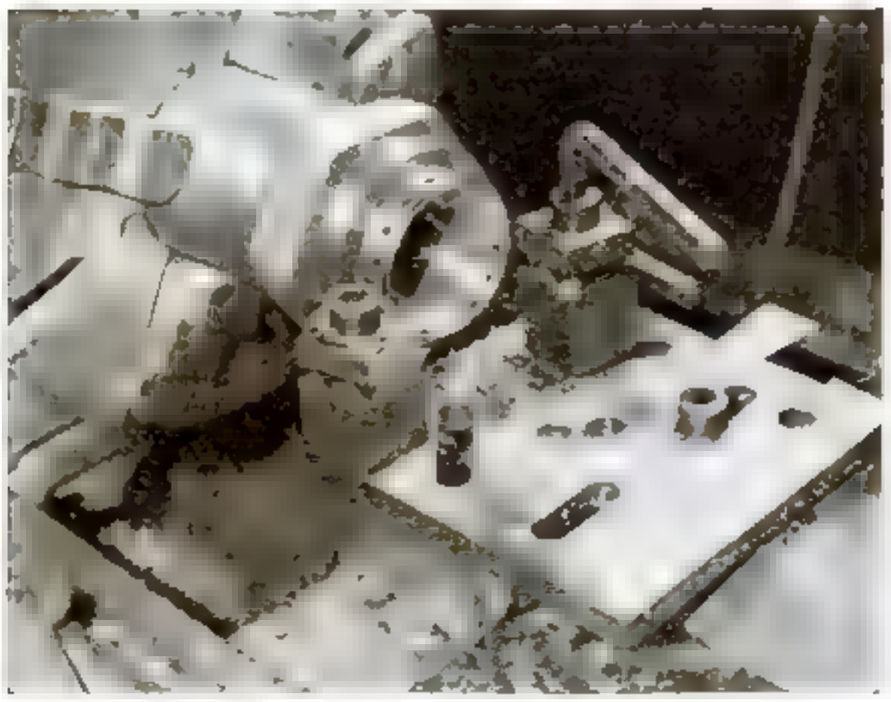
The dowel is held to the boards by two window-shade brackets cut down to fit the thickness of the drawing board and screwed into a metal core eye, which prevents wearing holes in the edge when attaching or removing the device from the board as may be desired by the draftsman.—JAMES F. SCHINDLER.





Power Hack-Saw Blades Given Longer Life

POWER hack-saw blades can be made to last longer by distributing the wear evenly along the blade. In the case of the usual type of power hack saw, which has a set stroke, this can be done by placing five plywood blocks ½ in. thick in the saw vise. With these blocks the work can be adjusted so the wear will be equalized.



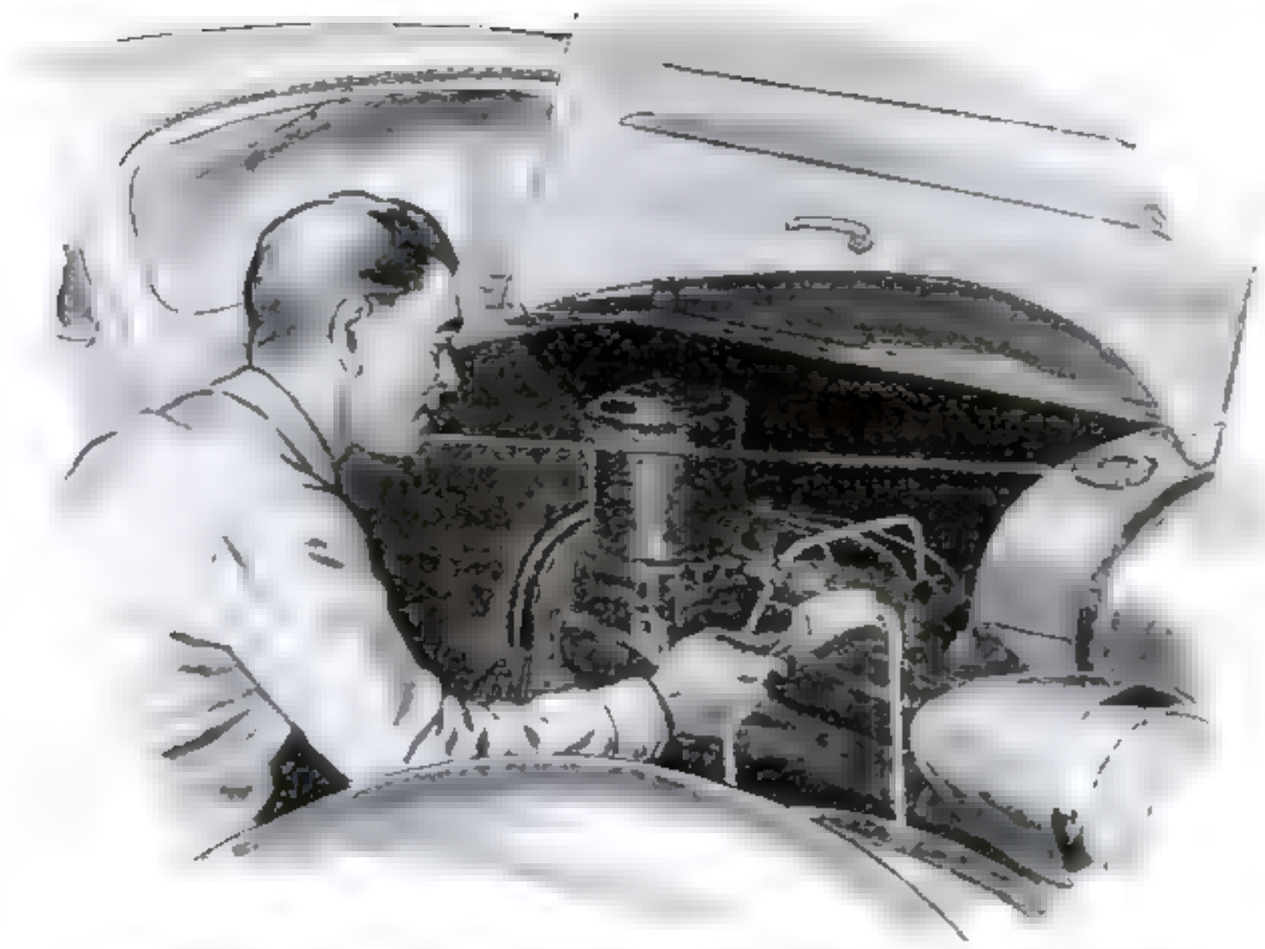
Multiple Tool Holder Speeds Lathe Work

THREE or more cuts may be made with one set-up by using the homemade lathe tool holder illustrated. For example, you can cut threads, inside and out, shoulder an adjusting collar, and cut it off, or face, chamfer, and taper-bore a part. Used in combination with the compound of the slide rest (where this will not conflict with the setting of the other cutters), it is possible to cut tapers with the same set-up.

The size of the plate will, of course, be governed by the size of the lathe. The one shown was made for a 10-in. lathe, and is 6 by 6½ by ⅝ in. It must be stiff enough to avoid any chatter. The arrangement of the slots is optional, and the other slots or holes for the tool-post screw may be added if found desirable.

Square cold-rolled stock was used for the tool posts, to support the cutters throughout their entire length, and socket-head cap screws for their toughness and durability.—R. G. BULLARD.

Timely Aids for Motorists

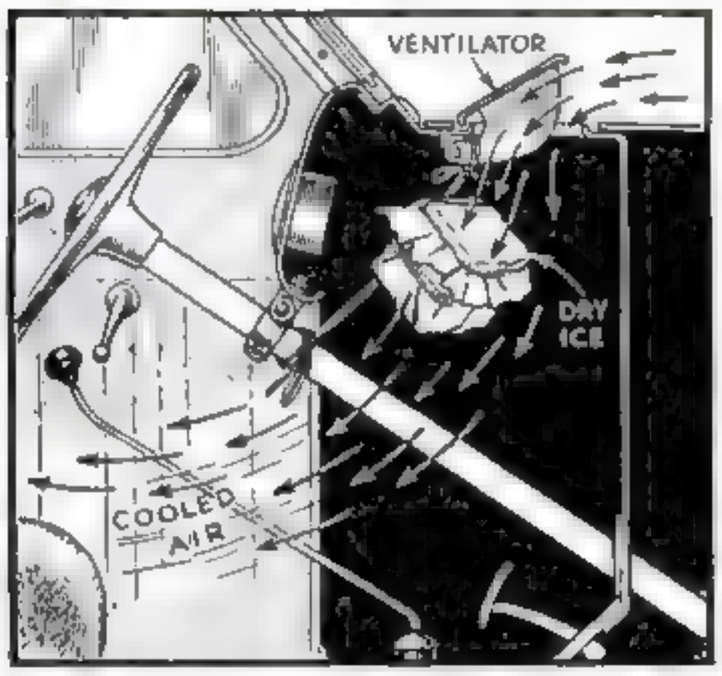


Leaks show up quickly when flour paste is brushed on a gas or oil pipe

Paste Finds Gas-Line Leaks

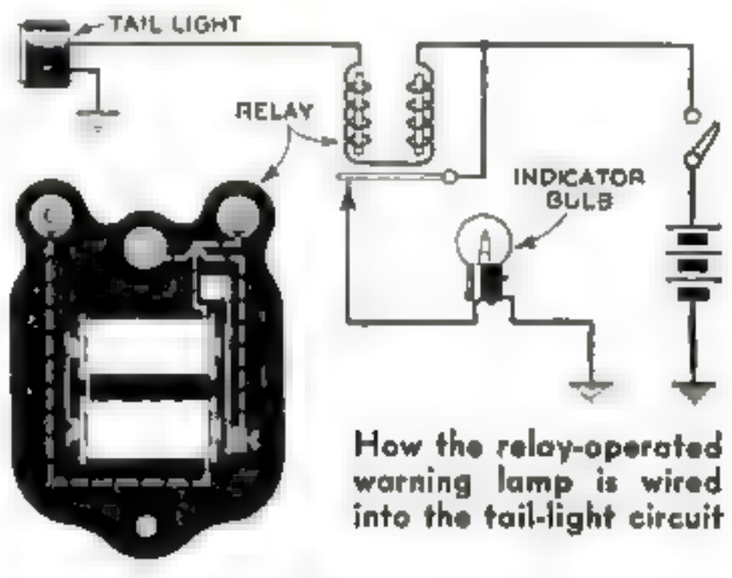
TINY seam leaks in the oil or gas line of a car, although they are negligible as far as wasted fuel is concerned, often disturb the correct functioning of the gasoline or oil system. The minute leaks are usually difficult to locate, but they invariably show up when the following method is employed. Wipe a suspected line with a clean cloth and then apply a mixture of lime and water, or flour and water, with the aid of a soft brush. This will dry almost immediately and a greenish-brown stain will form at points where there are small leaks. Once these are located, it is an easy matter to mend them by taping or soldering.—A.H.W.

Dry Ice At Ventilator Cools Closed Car



Tied under the ventilator, dry ice wrapped in paper cools fresh air entering the car

WHEN extreme summer heat makes your next long automobile drive too uncomfortable, stop at a drug store or roadside refreshment stand, buy a chunk of dry ice, and have it wrapped in heavy paper. Close all the windows of the car, open a cowl ventilator, and then suspend the dry ice just below and in back of this opening. Then turn back the paper covering. Air rushing through the ventilator and over the ice as you drive along will quickly cool the entire car. Because the dry ice vaporizes without melting, there will be no liquid drippings to spot enamel or upholstery. Be careful not to handle the ice itself, as your fingers might freeze fast to it and cause you some trouble and discomfort before you got them loose.—W.B.



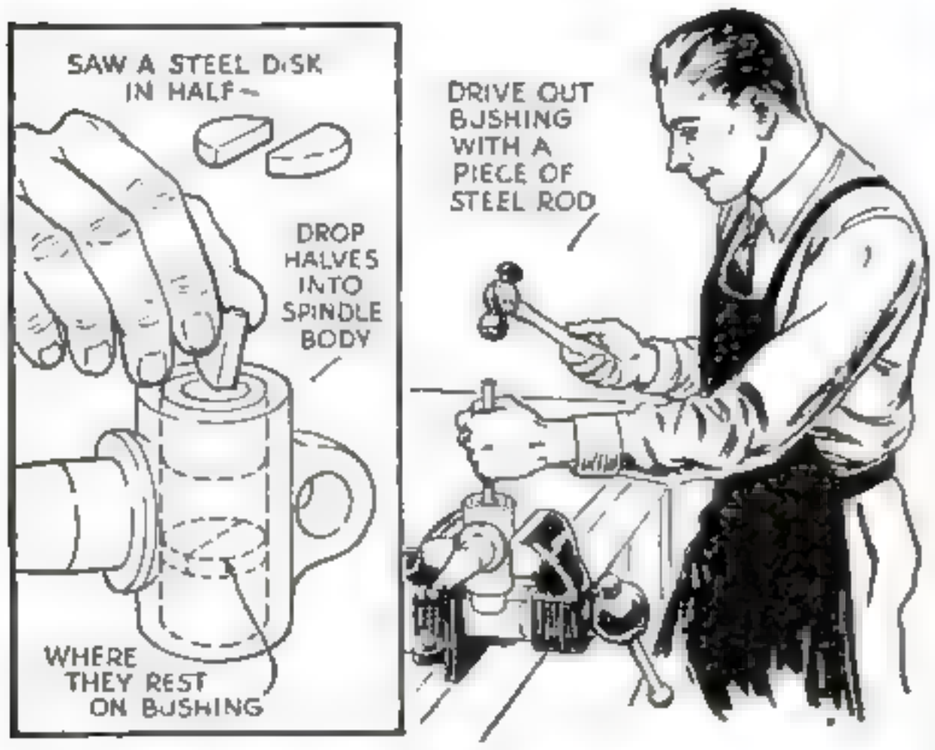
How the relay-operated warning lamp is wired into the tail-light circuit

Dash Light Warns of Burned-Out Tail Lamp

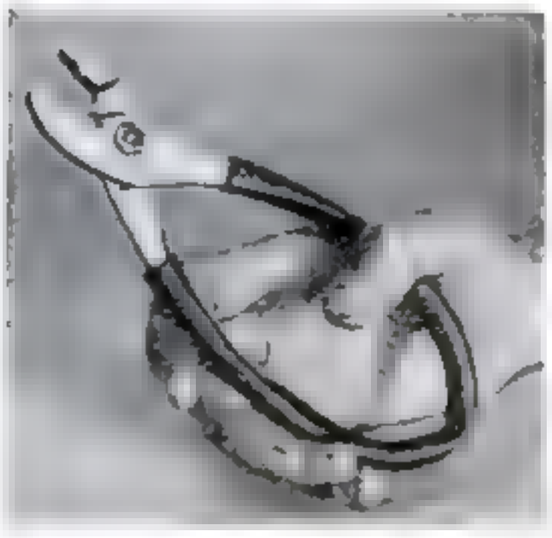
IMMEDIATE warning of a burned-out tail-light bulb is given to the motorist who rigs up the simple electrical circuit shown in the diagram above. A relay connected in series with the tail light is energized as long as the bulb continues to function. If it goes out, however, the relay magnet is de-energized, releasing an armature which is drawn up by a spring to make contact and light the warning bulb on the dash.—D.C.L.

Disks Drive out Bushings

TO REMOVE spindle bushings quickly, cut a half-inch disk from a steel rod slightly smaller in diameter than the bushing. Saw this in two and drop the halves inside the spindle, maneuvering them with a wire until they lie flat. Then, by inserting a bolt or punch against the disk halves, the bushing can easily be knocked out with a hammer.—W.H.A.



Cutting the small disk in half allows its two parts to pass one bushing so that the other can be driven out

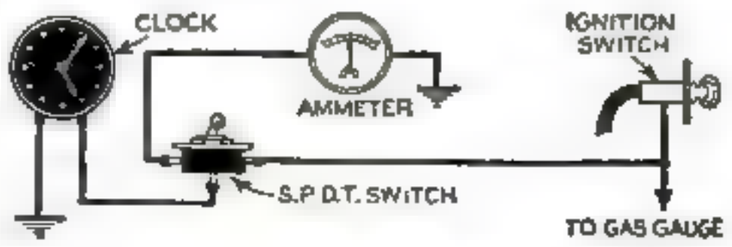


Rubber Hose Holds Pliers Open

WHEN working with pliers in cramped or awkward spots around a car, fit a section of small-size rubber hose over the handles, as pictured above. The hose will then spring the plier jaws apart for a fresh hold whenever you loosen your grip on the handles. Incidentally, the hose will also serve to insulate the pliers when you are doing electrical work, either on your car or on the lighting circuit of the house.—F. C.

Auto Clock Registers Driving Time on Trips

BY CONNECTING the self-starting electric clock in my car to the gasoline-gauge lead on the ignition switch, I can use it as a fairly accurate indicator of total driving time on cross-country trips, since the clock starts when the engine does and stops only a few minutes after the motor is switched off. A switch, wired as shown below, allows the clock to be used as a conventional timepiece.—J.D.D.

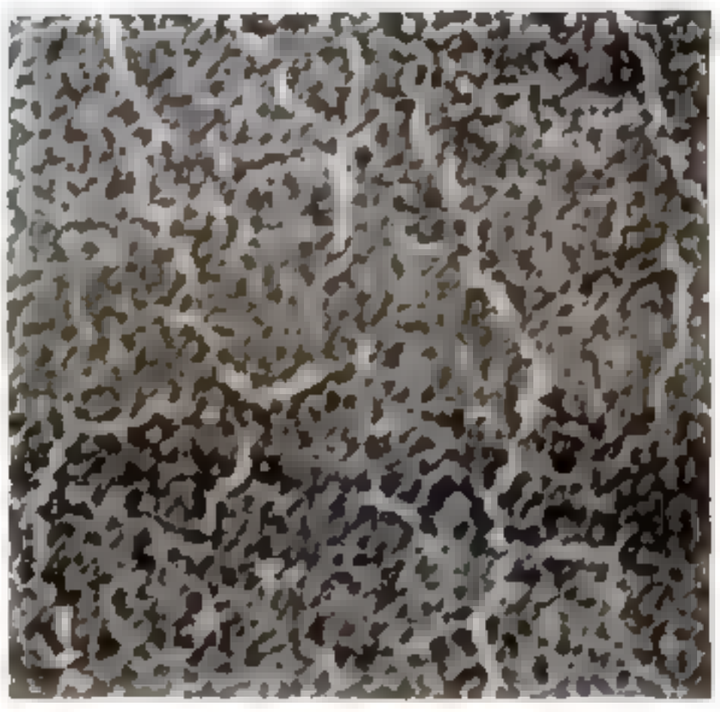


To show driving time, the clock is wired to ignition switch which turns it off and on

YOU CAN UNCOVER THE Secrets of Photography WITH YOUR MICROSCOPE

Natural-color film transparencies are excellent microscope subjects. The dye images are easily studied

Right, film-negative emulsion showing "reticulation" caused by sudden cooling while film was wet. Below, how film developed with ordinary chemicals compares with that processed in special fine-grain solutions and with positive movie film



By MORTON C. WALLING

PHOTOGRAPHY and microscopy often travel hand in hand, largely because the making of pictures through the microscope is a fascinating and useful activity. But there is another way in which the microscope and the camera can work together. Remember, the microscope was always a "candid" instrument. By using it as a kind of photographic accessory, you can draw on its power to make little things look big, and discover the hidden secrets of film, developers, and other materials of picture making.

You may be a camera bug to whom there is nothing more thrilling than running down some obscure trouble in a miniature-camera film. And again, you may not care a whoop about picture making as a hobby. But if you are a serious microscope enthusiast, sooner or later you will want to make photomicrographs. And you will produce better results if you first do a little exploring with your microscope of some of the important phases of photography. Besides, you'll find it a lot of fun.

Illustrated magazines are using natural-color photographs in ever-increasing numbers, both on the covers and inside. Some of these pictures fill almost a whole page. But, did you know that many, perhaps most of them, were reproduced from transparencies, that is, transparent colored films, measuring only about one by one and a half inches? Such enormous enlargement of tiny color transparencies without loss of detail is possible because the image is composed of dyes rather than grains of metallic silver. In other words, the image is practically grainless.

If you can obtain a color picture on 35-mm. film, the size usually employed, you can have a lot of fun examining it with your microscope. At fifty or so diameters, the detail remains surprisingly sharp and distinct, and with your microscope you can read obscure signs and observe other things that are difficult to see even when the picture is projected on a screen in the usual manner.

Photographers seem to worry about grain more than anything else, particularly if they are users of miniature cameras. Grain, in this case, refers to the particles of silver, or clumps of particles, forming a photographic image. Because of their small size and the necessity of subsequent enlargement to produce a useful print, min-

lature-camera negatives must be fine-grained. Various developers have been devised to keep the grain size down, although grain never is entirely lacking. The photographer who has a microscope can keep tab on the grain size of his negatives without the necessity or expense of making prints from them. All he has to do is clamp a bit of film on the microscope stage, with or without a glass slide to help support it, and examine the silver image at magnifications of 100 diameters and up. Only for extremely close study, such as study of grain shape, are powers as high as 1,000 diameters required.

In this way, the camera enthusiast can compare the grain produced by various developers, and select the one that suits his purposes best. He also can compare different films on the basis of grain size, and discover for himself the fact that positive motion-picture film developed in a coarse-grain developer usually has a finer grain than fast, panchromatic film processed in a fine-grain formula!

Sooner or later, every photographer, particularly the miniature fan, bumps squarely against a film "disease" known as reticulation. He will find that a prized film has a dull surface that, on close examination with the naked eye, looks somewhat like textured leather. When a print is attempted, the picture is found to be overlaid with a network of fine lines. Reticulation is most common in warm weather. Under the microscope, the emulsion (gelatin coating containing the silver salts before development, and the metallic silver image afterwards) is seen to be broken up much like the cracked mud on the bottom of a dried-up pond.

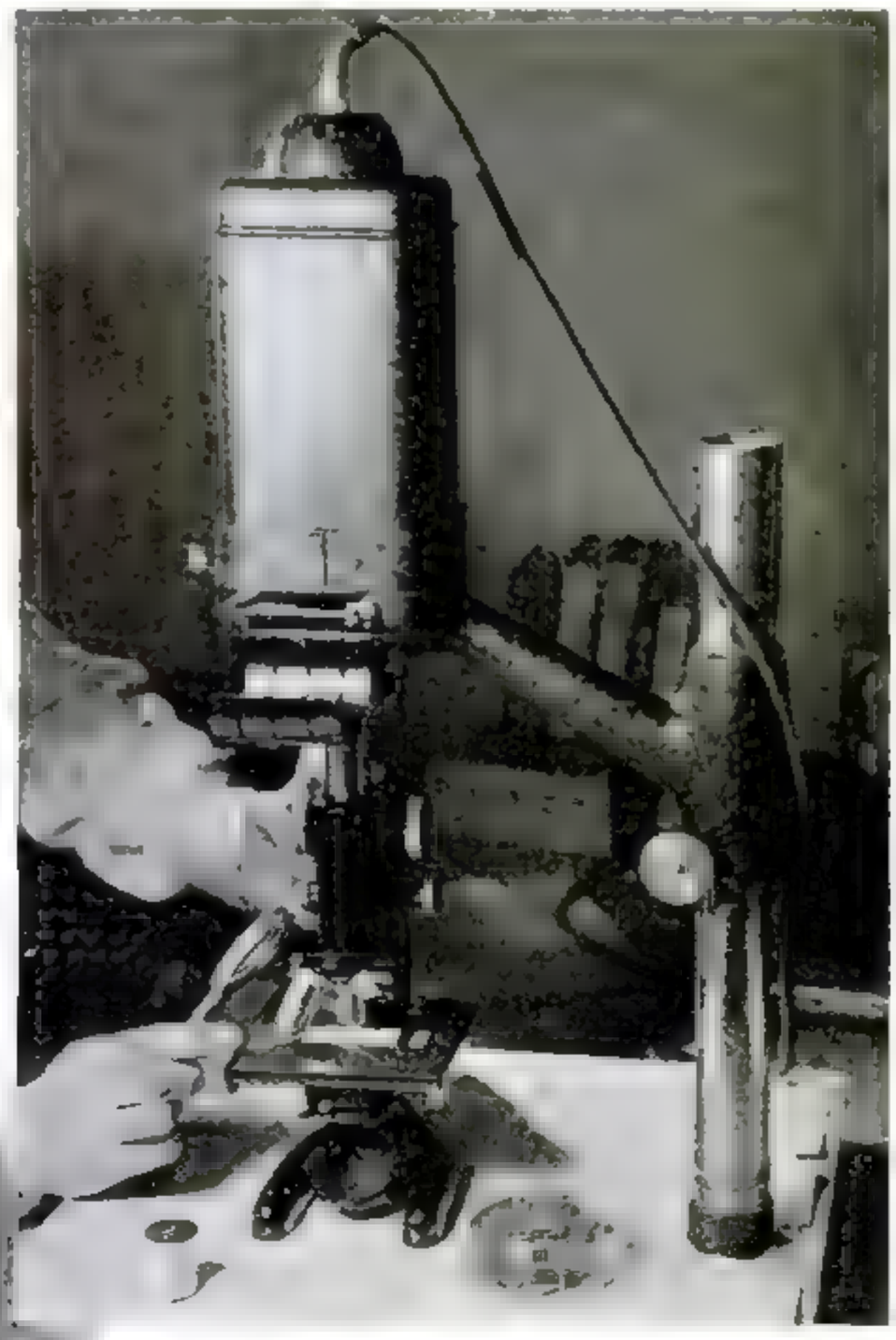
Careful examination at moderate power sometimes shows that the cracks are in only one layer of a double-coated film. The film frequently looks as if it were marked with innumerable, tiny folds forming a close network, instead of cracks. Care must be taken in making the diagnosis, for merely by shifting the microscope focus a trifle, reticulation cracks, which are lighter than the surrounding emulsion, can be made to change into dark lines that look like tiny ridges or folds. Such is the fickleness of light! Reticulation can be prevented by keeping the temperature of all solutions and the wash water the same—sixty-five to seventy degrees Fahrenheit.

By placing some dilute developer on a piece of film on a slide, you can watch the developing process through your microscope

A stunt that will provide considerable entertainment for the microscopist-photographer is the observation of film development through the microscope. Cut a small piece of film and lay it on a slide. Cover it with a clean cover glass, and focus your microscope on the film emulsion. With a pipette or medicine dropper, place a small quantity of dilute developer at the edge of the cover glass. Capillary attraction will draw it across the film, wetting the emulsion. Watch carefully all the time through the eyepiece, for development will begin quickly and proceed rapidly. Thus you can actually see the basic chemical reaction of photography—the transformation of silver bromide particles into tiny grains of metallic silver which, because of its finely divided state, is black.

A very useful stunt is to employ the lowest power of your microscope to examine the *(Continued on page 100)*

At the left, a microphotograph, or tiny photograph, made on a glass lantern-slide plate is being mounted on a microscope slide. Below, solutions of photographic chemicals are placed on slides to evaporate, forming beautiful crystal patterns



For making microphotographs, a microscope is substituted for the lens of a photographic enlarger. A hand lens helps to focus the image upon the film

Cleaner Air To

How smoke is eliminated electrically in a factory chimney is demonstrated by the easy experiment illustrated at the left

"MONOXIDE Kills Two in Garage." "Farmers Protest Ruin of Crops by Smelter Fumes." "Solvent Vapors Fell Three." Newspaper headlines like these proclaim the constant menace of polluted air to life, health, and property. Beneath much smaller headlines you may also read, from time to time, how chemists are combating the perils of noxious gases, smoke, and dust in the atmosphere—and sometimes eliminating them completely. Some of the means that have been found effective for purifying the air, and for warning when it is unfit to breathe, will be interesting to try out in your own home laboratory.

The remarkable power of finely divided charcoal to "adsorb" or remove impurities in the air affords a striking experiment. Because of this property of charcoal, it is one of the principal ingredients in the contents of canisters of wartime masks for use against poison gases. To test its effectiveness in your laboratory, the odor of an onion will take the place of the gas.

Suspend a slice of onion in a side-necked test tube, and arrange to pass a slow current of air past it. This may be done by letting water flow from a full gallon jug, through a siphon, to an empty gallon jug at a lower level. This drives air from the empty jug, through suitably arranged tubing, into the side-necked test tube, where it bubbles through water in the bottom of the tube. The water serves as a telltale device to aid in keeping the flow of air constant—say, one bubble a second.

Lead the escaping air from the side-necked test tube through a piece of glass tubing about half an inch in diameter and ten to twelve inches long, containing three plugs of absorbent cotton. Your nose will readily detect the odor of the onion in the air issuing from the apparatus.

Now fill the space between the plugs of cotton with powdered charcoal, replace the tubing, and proceed as before. This time you will be unable to smell the onion. You can substitute other odorous objects for the slice of onion, to see whether the charcoal will work as well with them. In industry, practical use is made of the way charcoal clings to the impurities that it abstracts from the air, for the profitable recovery of solvents that would otherwise be wasted.

Fumes and metallic dusts, belching from the stacks of smelters, once destroyed all vegetation for miles around. Now they have been conquered by an electrical process that precipitates or settles the smoke before the hot gases leave the chimney. On a small scale, you can reproduce this remarkable "Cottrell process," as it is named after its inventor, in your home laboratory.

To represent the chimney from which smoke is to be precipitated electrically, mount a glass tube about three quarters of an inch in diameter and a foot or more in length in an upright position. Run a thin piece of copper wire—say, No. 30 B. & S. gauge—up through the tube and back down the outer side, twisting it together at the bottom to make a closed loop. Make a second loop in the same fashion, at the opposite side of the vertical tube. These loops will serve as electrodes, and should not touch each other at any point. Connect them to any convenient source of high-voltage electricity. Ordinary house current will not do, but you may use an automoble spark coil, a laboratory induction coil, or a step-up transformer such as a neon-sign transformer operating from 110-volt alternating current. To avoid a shock, take care not to touch the electrodes while the current is on.

Hold a stick of burning punk or an ignited cone of incense beneath the tube, so that the smoke will rise through it. With the current off, the smoke will

Exhaled breath shows more carbon dioxide than the air

Detecting Dust, Fumes, and Poisonous Gases in the Atmosphere, and Getting Rid of Them, Is One of the Jobs of Industrial Chemistry

By RAYMOND B. WAILES

Breathe

HOME-LABORATORY TESTS EXPLAIN PURIFICATION METHODS

emerge from the upper end. Turn on the voltage, and the smoke will magically disappear. What happens is that the suspended particles composing the smoke become electrically charged and are attracted to the wires, removing themselves from the stream of heated air. In commercial applications, the precipitated particles then fall by gravity to a catch bin at the bottom of the flue. Not only is smoke abated, but valuable metallic dusts are recovered before they escape into the air. Cement and slate-milling plants have also found the process a boon for abolishing dust, and it has been applied for tar removal in gas manufacture.

Far more insidious and deadly than the most obnoxious smoke, however, is the poisonous vapor that miners know as "white damp," motorists and naval gunners as "monoxide," and chemists by its full name of carbon monoxide. Invisible and odorless, it strikes without warning. By a simple chemical test, however, its presence in the air may be detected.

Palladium chloride is the name of the substance to use, and the test with it for carbon monoxide is so sensitive that the smallest quantity you can buy of this rather expensive chemical will be sufficient. Dissolve an amount of palladium chloride about the size of a pinhead by heating it in five cubic centimeters, or approximately one and a half teaspoonfuls, of water. To test a flaskful of air for the presence of carbon monoxide, one cubic centimeter of this solution may be poured into the bottom of the flask.

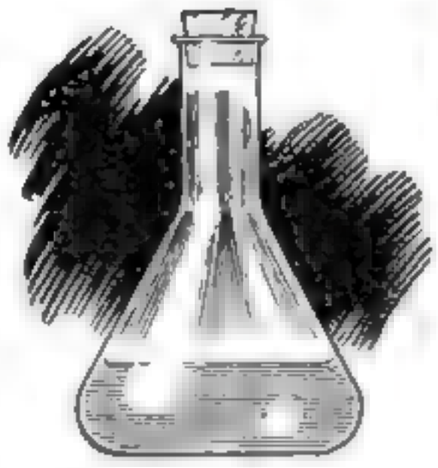
Try waving a flask in the air, after inserting this amount of the palladium chloride solution, within six feet of the exhaust-pipe opening of a running automobile motor. Then cork the flask and await developments. A second flask containing a like amount of the solution may be exposed to ordinary air and corked for comparison.

After the first flask has stood for twenty-four hours, you should be able to observe a black film of palladium metal that has formed upon the liquid exposed to carbon monoxide. The liquid in the second flask will be devoid of such a film.

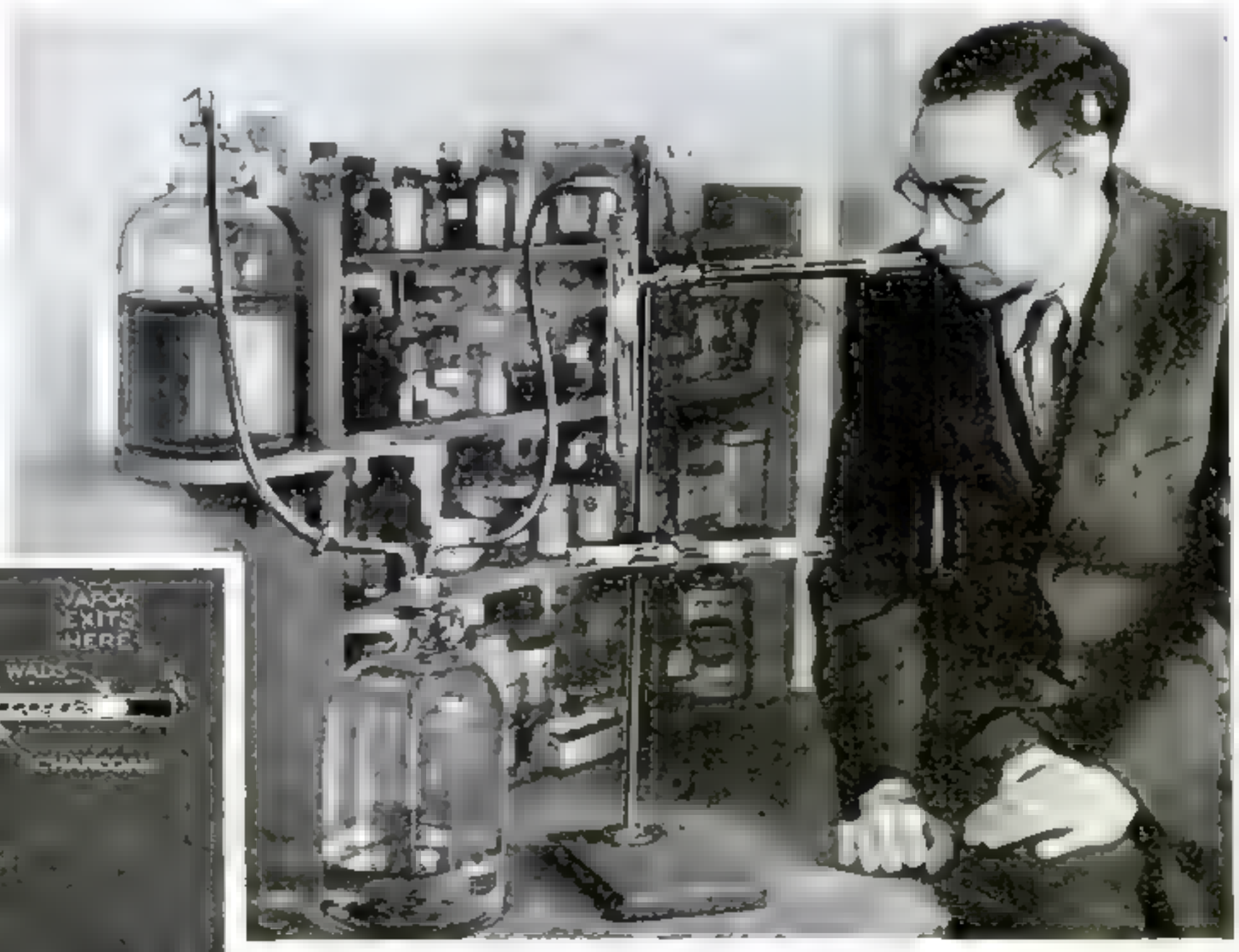
Now, as a confirming test, add to the first flask five cubic centimeters of a solution made by grinding five grams (about a teaspoonful) of ammonium molybdate in a mortar with 100 cubic centimeters (or a little less than half a glassful) of water. Then add 100 cubic centimeters of a hydrochloric acid solution made by mixing ten cubic centimeters of strong, chemically pure hydrochloric acid with ninety cubic centimeters of water. Let the flask stand for twenty-four hours more. The beautiful blue color that will appear within this time confirms the presence of carbon monoxide. It will not be produced when the contents of the second flask are treated in the same way.

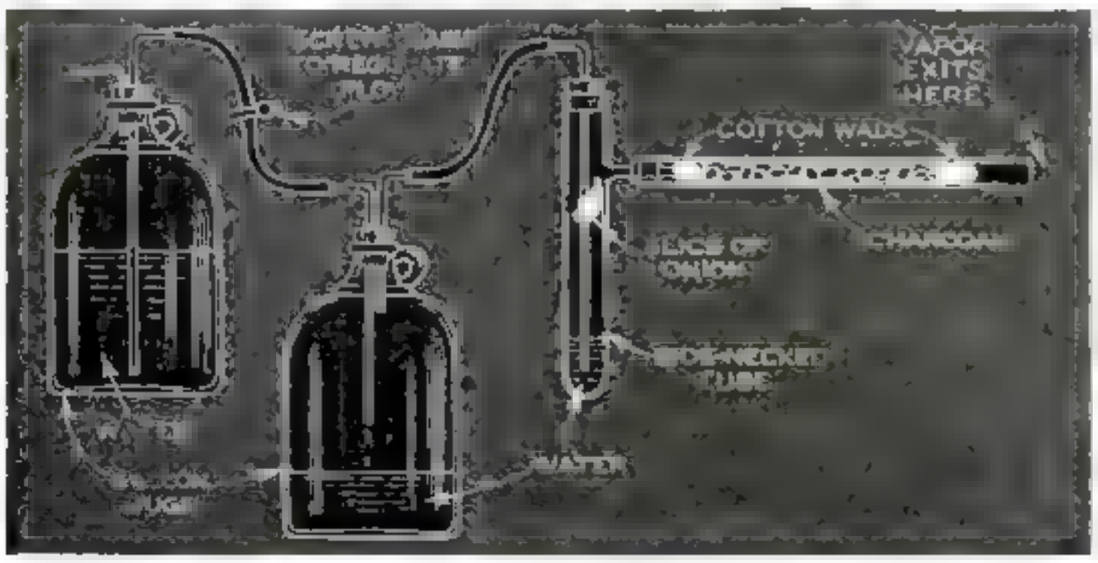
By the means just described, air can be tested in any locality where contamination with carbon monoxide is suspected—from automobile exhausts, a defective heating plant, or any other source. For collecting such air samples, a flask may be fitted with a rubber bulb like that of a perfume atomizer, so that a few squeezes of the bulb will fill it with the air to be tested. The palladium chloride solution should always be made up freshly before use. The sensitive confirming test producing the blue coloration is a recently developed one, new even to professional chemists.

In contrast with deadly carbon monoxide, carbon dioxide gas is not ordinarily considered poisonous. This is the gas that makes *(Continued on page 92)*



A simple chemical reaction detects carbon monoxide in a sample of air captured near an automobile exhaust, as seen at the right





This apparatus shows how wartime gas masks work, by removing onion odor from the air. Powdered charcoal "adsorbs" the pungent aroma

KNAPSACK

Two small packs—one worn in front, the other in back—house the complete earphone receiver

By ARTHUR C. MILLER

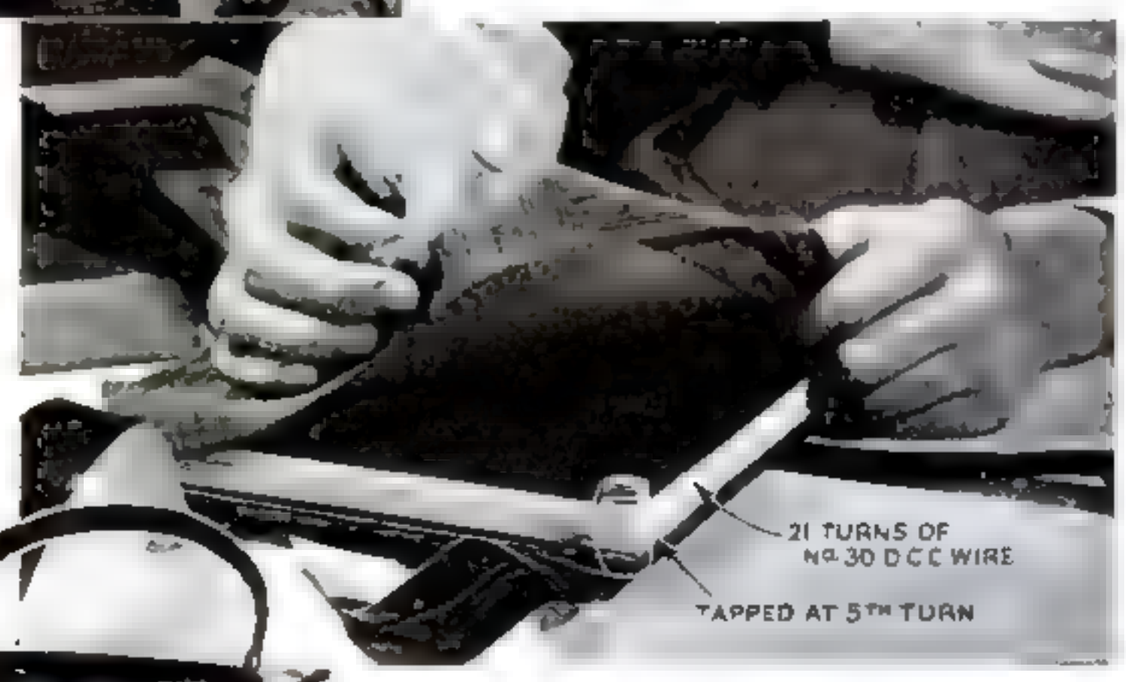
HAVE you ever wished for a small, lightweight radio that you could take with you on your summer bicycle jaunts or hikes into the woods? It was to fill this need that the author designed the compact knapsack receiver illustrated. Powered by its built-in battery supply, and needing no other antenna than its own specially designed frame aerial, this novel radio will enable the user to receive his favorite programs while he is walking along the country lanes, or pedaling his bicycle.

The knapsack receiver can be slipped on in a few seconds, being worn in much the same way as a life preserver. As shown in the photographs, the outfit is divided into two sections. One half, which is worn in front, contains the receiver circuit and the power supply. The other half, worn flat against the back, houses the specially designed loop antenna.

In order to insure satisfactory reception when at a distance from local stations, and because of the low efficiency of the loop compared with ordinary ground and antenna, the knapsack receiver employs a sensitive five-tube untuned radio-frequency circuit. Because of their low battery consumption and small size, special midget tubes, which have been recently placed on the market, were used. Although designed primarily for use in the automatic ultra-midget transmitters that are attached to balloons for meteorological purposes, they make good receiver units. They operate on a single dry cell, and their low filament consumption makes it possible to design a receiver with a total "A" drain of only 300 milliamperes.

Although the circuit design calls for five tubes, by using a dual-purpose unit, the actual number of tubes is reduced to four. The RK43 tube provides two separate triodes. The tubes are mounted on a chassis measuring 1¼ by 8 in. Standard midget wafer sockets are used, but since their diameter is slightly more than 1¼ in., they must be cut down to the required diameter with a pair of strong shears in order to fit on the chassis.

To obtain the highest possible amplification from the two untuned radio-frequency stages, chokes with an iron core were selected. An 80 millihenry choke serves for the first stage, while a 125-millihenry unit is used in the second. It is necessary to use chokes of different values to prevent the two stages from oscil-



The antenna pack, shown at the extreme left, consists of a wood frame supporting the loop aerial and a cloth cover to protect it from the dust and rain

RADIO for Cyclists and Hikers

lating and thus spoiling the reception.

Insulated mica fixed condensers were used throughout the entire receiver, even for the coupling condensers in the two audio-frequency stages. This was necessary to save space. Also, since it was out of the question to use a large air-spaced tuning condenser, one of the new ultra-midget insulated types was chosen instead.

The cabinet for the receiver circuit is constructed entirely of 1/16-in. aluminum, and consists of two parts, a back and a front so designed that one slides inside the other to form a completely inclosed cabinet measuring 1⅝ by 8 by 9¼ in. in outside dimensions.

Only two controls are needed to operate the set, and these are mounted one above the other on the front of the cabinet as shown in the photographs. The upper knob operates the on-and-off switch and the 15,000-ohm potentiometer to control the oscillation of the first tube. The lower knob is for tuning to the various stations. On the right side of the chassis are the two insulated binding posts which serve as connections for the headphones. These headphones should be of the featherweight type, weighing but a few ounces, thus enabling the user to wear them for long periods without fatigue.

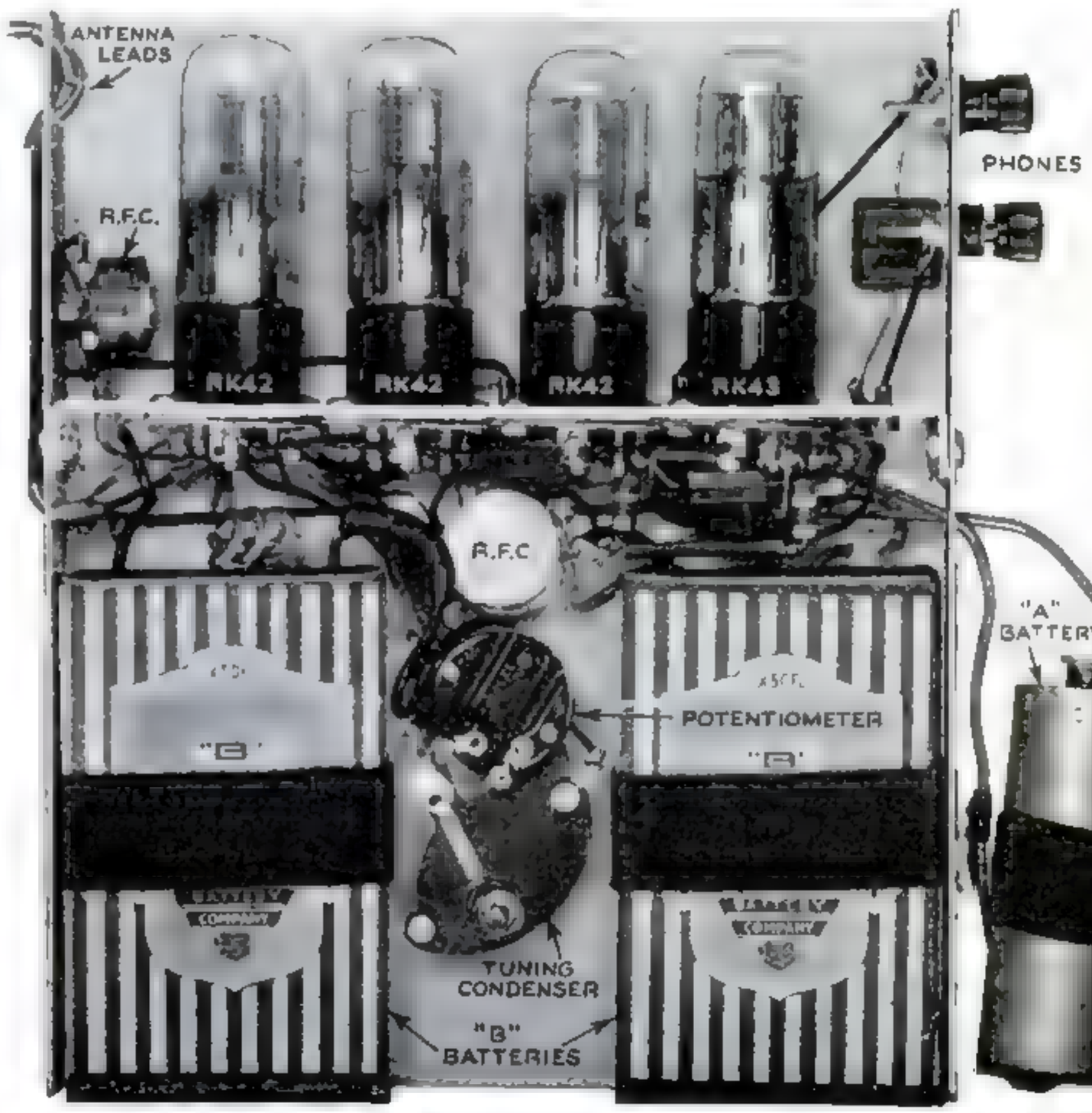
Below the two binding posts are two rubber-insulated flexible leads connected to the small 1½-volt "A" battery which is fastened by means of an elastic band to one of the leather shoulder straps. As shown in the photographs, the two midget forty-five-volt "B" batteries are held securely in place inside the cabinet by black elastic bands 1 in. wide. These bands can be attached to the aluminum panel with paper fasteners or pieces of stiff, light wire.

In the photograph showing the rear of the receiver circuit, three insulated wires can be seen extending through the side of the cabinet. These are the antenna connections, and lead over one shoulder strap to the special loop antenna that forms the back pack. The antenna consists of twenty-one turns of No. 30 double-cotton-covered wire wound on a wood frame consisting of a ⅝ by 8 by 9½-in. baseboard fitted with 1-in. corner posts to support the wire. The aerial should be tapped at the fifth turn; this smaller section serving as the equivalent of a tickler coil. To protect the antenna, a cloth cover should be made. This can be of any convenient waterproof material held in place with nails or short straps.

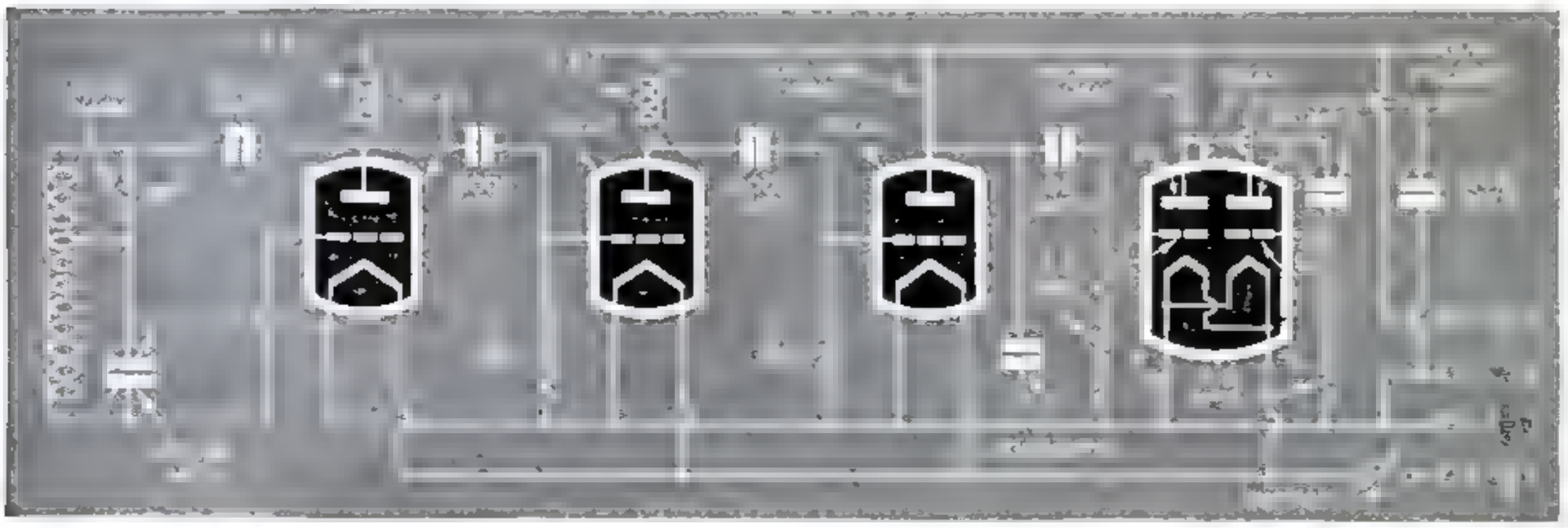
WHAT YOU NEED

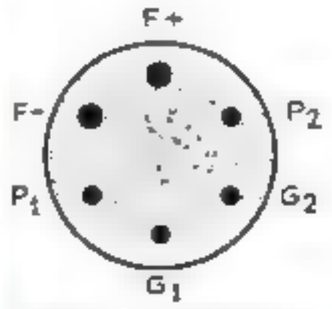
Volume control and switch, 15,000 ohms.
Tuning condenser, wafer-type, .00036 mfd.
Plate choke, iron-core, 80 mh.
Plate choke, iron-core, 125 mh.
Fixed condenser, mica, .0003 mfd.
Fixed condensers, two, mica, .0005 mfd.
Fixed condensers, two, mica, .01 mfd.
Fixed condenser, mica, .004 mfd.
Fixed resistor, 2 meg., ½ watt.
Fixed resistor, 3 meg., ½ watt.
Fixed resistors, two, ½ meg., ½ watt.
Fixed resistor, 100,000 ohms, ½ watt.
Fixed resistor, 50,000 ohms, ½ watt.

Miscellaneous: Tubes, wafer sockets, knobs, dials, two-piece cabinet, chassis, earphones, two forty-five-volt "B" batteries, one midget 1½-volt cell, wire, solder, etc.



This rear view of the receiver panel shows how the circuit and power supply are arranged

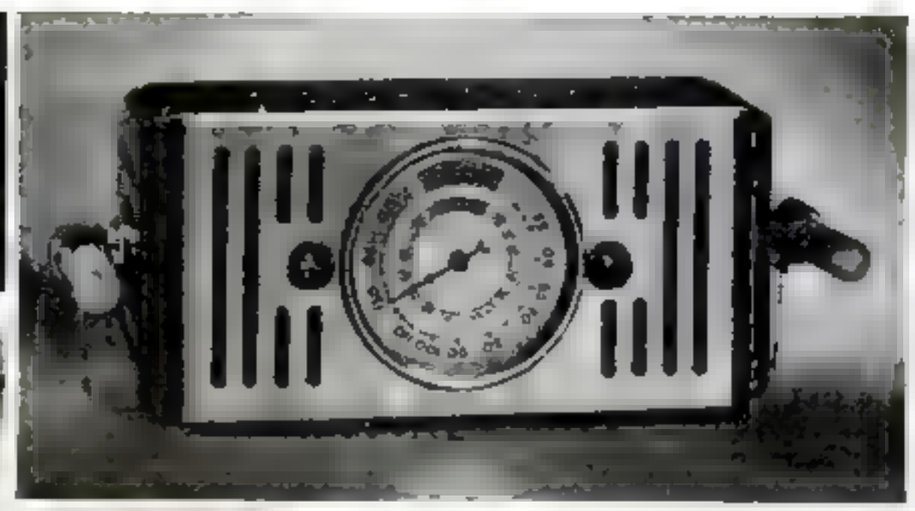




SOCKET CONNECTIONS FOR RK43 TUBE

Five-tube results are obtained with four tubes when connected as at left. Above, the socket diagram

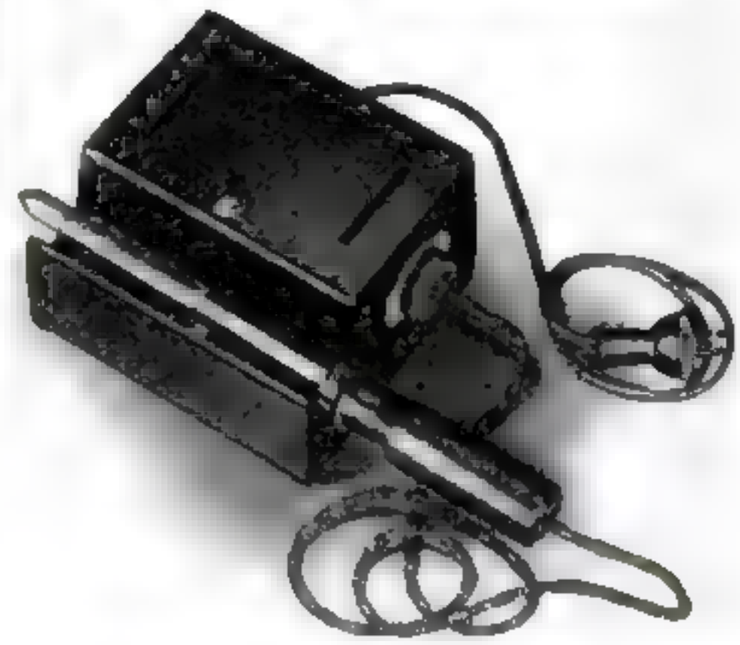
New Ideas for Radio Fans



Fastened on your bed, this combination radio and reading lamp forms a convenient bedroom accessory

WITH its illuminated dial facing down for convenience, a novel radio designed to be fastened on the head of a bed also serves as a convenient reading lamp. The compact and efficient receiver consists of a metal-tube circuit covering both the broadcast and short-wave bands and operating on either alternating or direct current. Two small frosted bulbs on either side of the decorative cabinet provide the necessary light for reading. Metal hooks hold the unit in place on the bed.

Soldering-Iron Stand Prevents Overheating



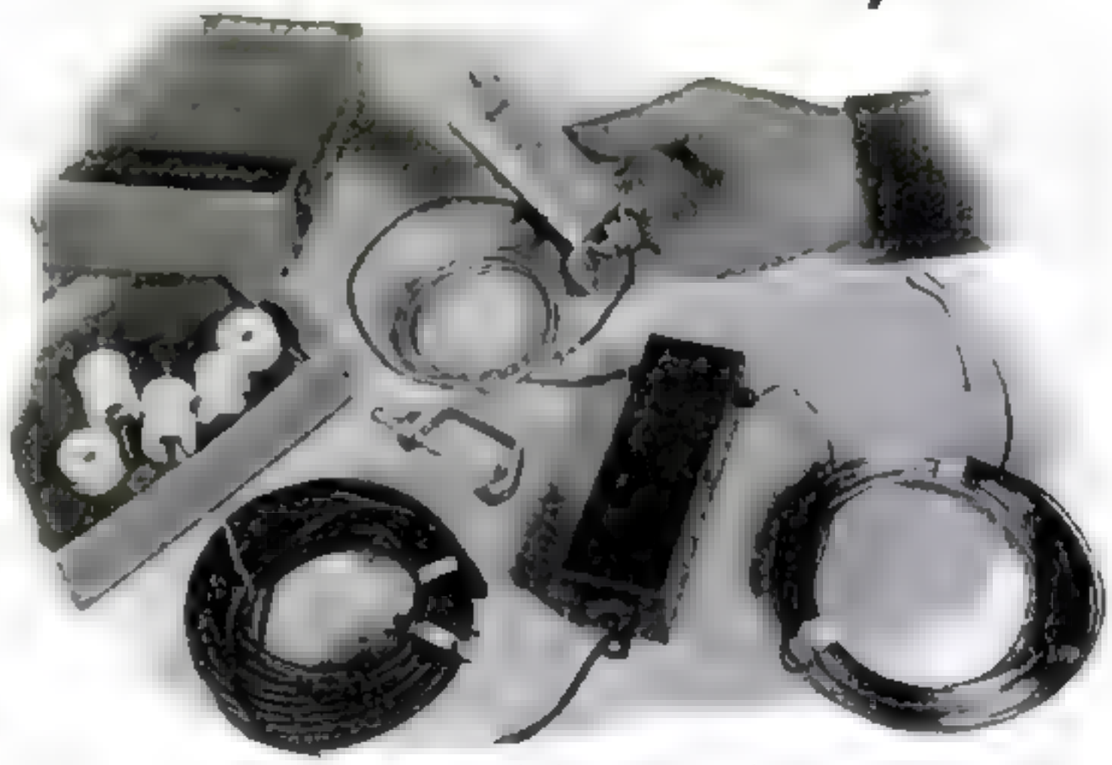
HOLDING an electric soldering iron at a uniform working temperature during continued use, an automatic stand protects the iron's tip from damage caused by continued overheating. Placing the iron in a groove in the stand, as illustrated, automatically switches off the full voltage and applies a reduced, "idling" voltage from a built-in step-down transformer.

Tiny New Electrolytic

SMALLER than a package of mints, a new electrolytic condenser is now available in a wide variety of capacities from four to forty microfarads, and in working voltages ranging from 100 to 450. Despite its small size, the condenser is sealed in a metal can and protected by a strong paper jacket. Long leads support the unit.

All-Wave Antenna Is Packed in Handy Kit

COMPLETE even to insulators, a handy antenna kit contains all the necessary parts for an efficient, all-wave antenna for amateurs. It is said to reduce man-made interference effectively on all wave bands and requires no complicated antenna rigging. Parts included in the kit are magnetic-core antenna and receiver-coupling transformers, antenna, ground, and lead wires, and a ground clamp.



All the necessary parts are included in the all-wave antenna kit

Waterproof Condenser Is Sealed with Glass

So resistant to moisture that it can be even placed in a glass of water without injury, a unique fixed condenser, shown undergoing such a test at the left, is sealed within a glass tube by means of a special compound that in itself cannot be penetrated by water. The permanent seal eliminates the possibility of the condenser being damaged by moisture in the atmosphere, a frequent cause of condenser failure.

Transformer Has Adjustable Taps

MOVING four jacks from hole to hole in the panel of a transformer designed for small radio transmitters allows the current supply to be varied to give a range of voltages. The units are available for use by amateurs either as modulation or as driver transformers.

Pocket Folder Holds Parts for Making Tube Adapters

TUBE-BASE adapters for any tube can be quickly assembled from the parts contained in a handy pocket kit now available. By installing individual prong contacts in the holes of the adapter designed for the tube in question, any arrangement of connections can be made through the base prongs to connect earphones, a phonograph pick-up, or other accessory.

BUSINESS GIRL – 1938 MODEL – Office manager Olive Tucker keeps disarmingly calm despite nerve-nagging phones, buzzers, interviews. "If anyone needs healthy nerves, I do," Miss Tucker smiles. "That's one reason why I smoke Camels. They never get my nerves upset." Later—much later—Miss Tucker skips to the roof-top gym for a quick work-out. Next—shower—rub—a Camel—and she's off again! Tired? Miss Tucker's answer: "Camels give my energy a refreshing 'lift.'"

Cigarettes may *look* alike—but what an appealing difference there is in Camels!

As a smoker, you'll be interested to read what Miss Tucker, successful young office manager, said to Miss MacGregor about the difference between Camels and other cigarettes (at right).

"Olive, do you always serve Camels because you feel that there's a big difference between Camels and other cigarettes?"

THERE ARE LOTS of Camels around Miss Tucker's living room. Miss Tucker says: "Camels are the favorite with my guests and are delightful for topping off a meal. I smoke Camels 'for digestion's sake.'"

"I'm very glad you've brought that question up, Helen. I've tried many kinds of cigarettes, and I'm amazed at how *different* Camels are. Camels are extra-mild—they never bother my throat. And Camels taste good, yet never leave that 'cigaretty' aftertaste. In so many ways, Camels *agree* with me."

WELKER COCHRAN, who has won many championships at billiards, says about *his* choice among cigarettes: "Camels give me *real* smoking pleasure. Under the strain of a championship match, Camels never make me feel jittery or unsure of my 'touch.' 'I'd walk a mile for a Camel' too!"

Camels are a matchless blend of finer, MORE EXPENSIVE TOBACCOS —Turkish and Domestic

THEY ARE THE LARGEST-SELLING CIGARETTE IN AMERICA

ONE SMOKER TELLS ANOTHER

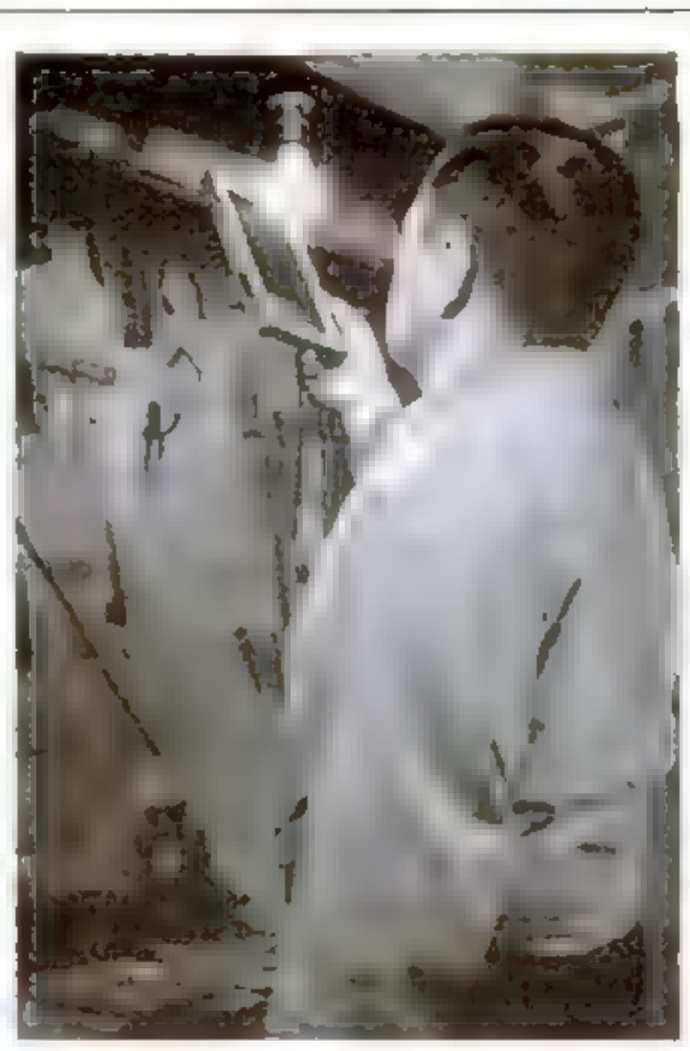
"CAMELS AGREE WITH ME!"

"You bet Camel is our choice of cigarettes," say these tobacco planters —and they *know* tobacco because they *grow* it!

Mr. George Crumbaugh, well-known planter, had his best tobacco crop last year. He says: "Camel bought the choice lots -paid more than I ever got before. Camel's the cigarette I smoke myself. Fact is, most planters favor Camels."

"I know the tobacco in various cigarettes," says Mr. Reckham Wright, 19 years a grower. "Camel got my choice grades last year -and many years back. I know Camels are made from MORE EXPENSIVE TOBACCOS."

Last year, Mr. Walter Devine says, his tobacco brought highest prices. "Camel took my best lots," he says. "Other planters also got top prices from Camel for choice grades. I'm partial to Camels. Most growers here are too."



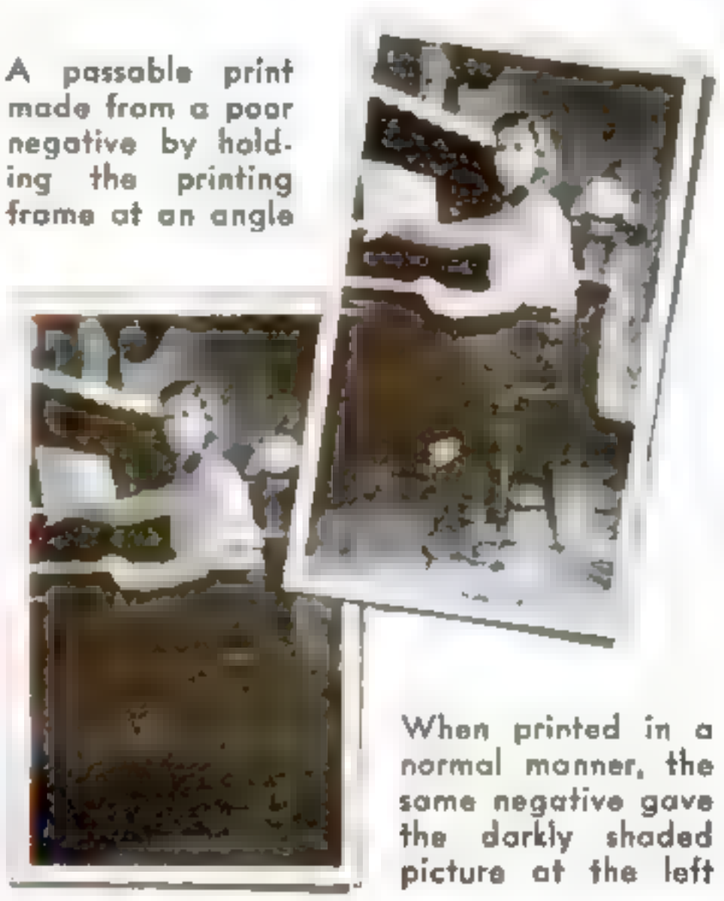
Bringing Out Details in Poor Negatives

A PHOTOGRAPHIC print that is too dark in some part because the original scene was unevenly lighted can often be corrected or at least greatly improved by using a hand printing frame and holding it at an angle to a lamp, as illustrated above. The two prints reproduced below, much reduced in size, show the remarkable improvement that can be made with this simple procedure.

If the negative is darkest at one end, tilt the printing frame at an angle of about 45 deg., with the thin part of the negative farther from the light. The distance from the light may vary from 1 in. for a very dark spot to a normal distance for negatives that are less unevenly gradated.

When there is a dark spot in the center, as sometimes happens, hold the frame with this spot about 1 in. from the center of the light and expose very briefly.

By this method, details will appear in the print that are entirely lacking when the normal printing procedure is used.—O.R.S.



A passable print made from a poor negative by holding the printing frame at an angle

When printed in a normal manner, the same negative gave the darkly shaded picture at the left

P. R. Nalder, secretary of the Coulee Dam (Wash.) Homeworkshop Club, at his lathe. Note how he carefully saves odd pieces of wood in racks nearby

The Guild Offers You a Hearty Welcome

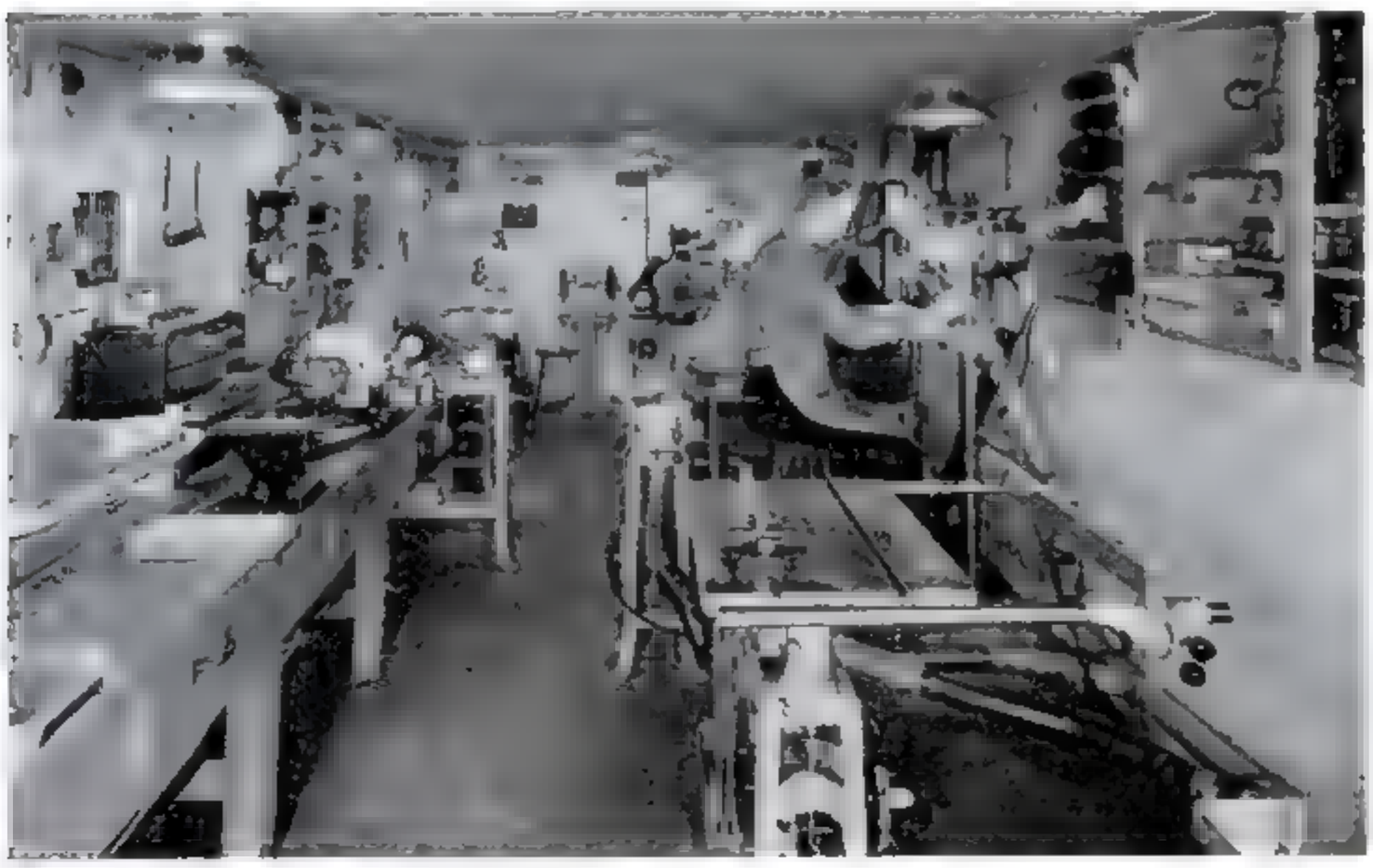
. . . IF YOU LIKE TO MAKE THINGS, THAT'S ENOUGH. YOU DON'T NEED AN ELABORATE WORKSHOP

Official Magazine POPULAR SCIENCE MONTHLY

WHAT'S your home workshop like? Is it the kitchen table on which you build ship models, a bench in the garage where home repairs are made, or perhaps an elaborately equipped shop in the basement for constructing almost anything? No matter what the equipment may be, the National Homeworkshop Guild would like to have you as a member, if you are at least sixteen years old.

You can, of course, be a lone wolf and keep your hobby to yourself, but thousands of home workshop enthusiasts in the United States now realize that their enjoyment increases greatly when they belong to home workshop clubs. Pictured on this page and on page 98 are a few Guild members and their shops. If they could speak to you, they would tell you how much more valuable their home workshops became when they began to associate with others interested in making things.

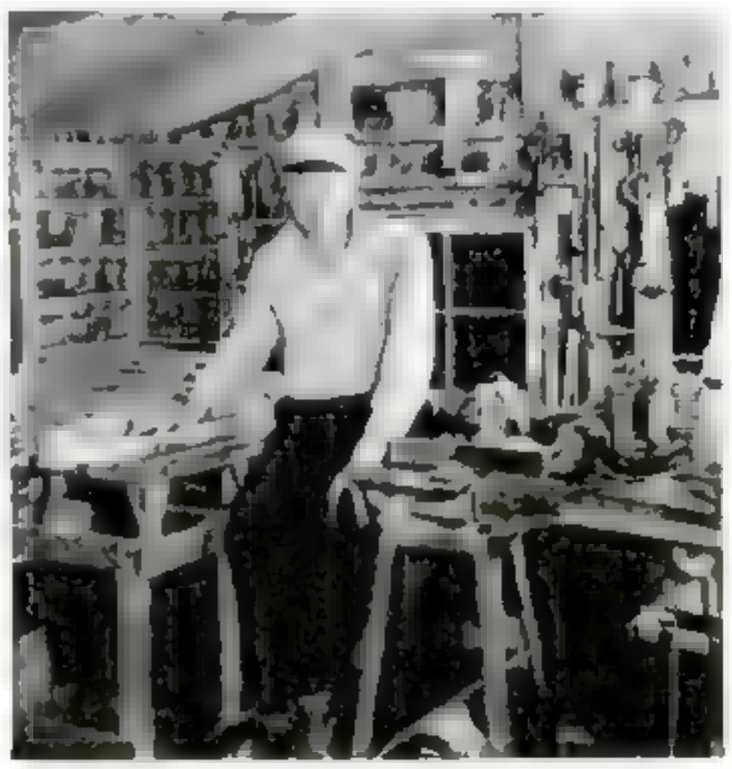
And your craftsmanship improves, too. Exhibitions held during the past few months provide a striking example of what Guild members are now able to accomplish. Ship models, inlaid pictures, metal silhouettes, pieces of furniture—nothing is too difficult or elaborate for some Guildcrafters to construct.



Herman Moodt, of the Lakeside Homeworkshop Club, owns the best equipped shop in Muskegon, Mich., perhaps in the entire Guild. It is set up in his basement and cost $1,800

Fourteen members of the Edison Club, *Chicago, Ill.*, won prizes in the annual contest and exhibition. The winning projects and their owners follow: ship model *Preston*, C. E. Knutson, Jr.; spinning wheel, L. Luetgert; lamp table, E. C. Groeschel; combination card table, Leo St. Jacques; marquetry panels, N. Clemens; steel silhouettes, L. L. Austin; twin end-table lamps, L. F. Holstein; pilot-wheel clock, J. H. Faulkner; inlay table, J. L. Williams; book ends, L. H. Juhnke; charcoal drawings, H. Conway; bowl and candlesticks, H. O. Sandberg; modern end table, J. J. Jensen; coffee table, D. G. Arnett. Norman Clemens has been elected president; O. L. Anderson, vice president; E. M. Dittmer, secretary-treasurer; Leo St. Jacques, librarian.

Approximately 1,200 persons attended the hobby show which the *Seattle (Wash.)* Homeworkshop Club held



The home workshop of J. T. Potts, a former president of the Jacksonville, Fla., club

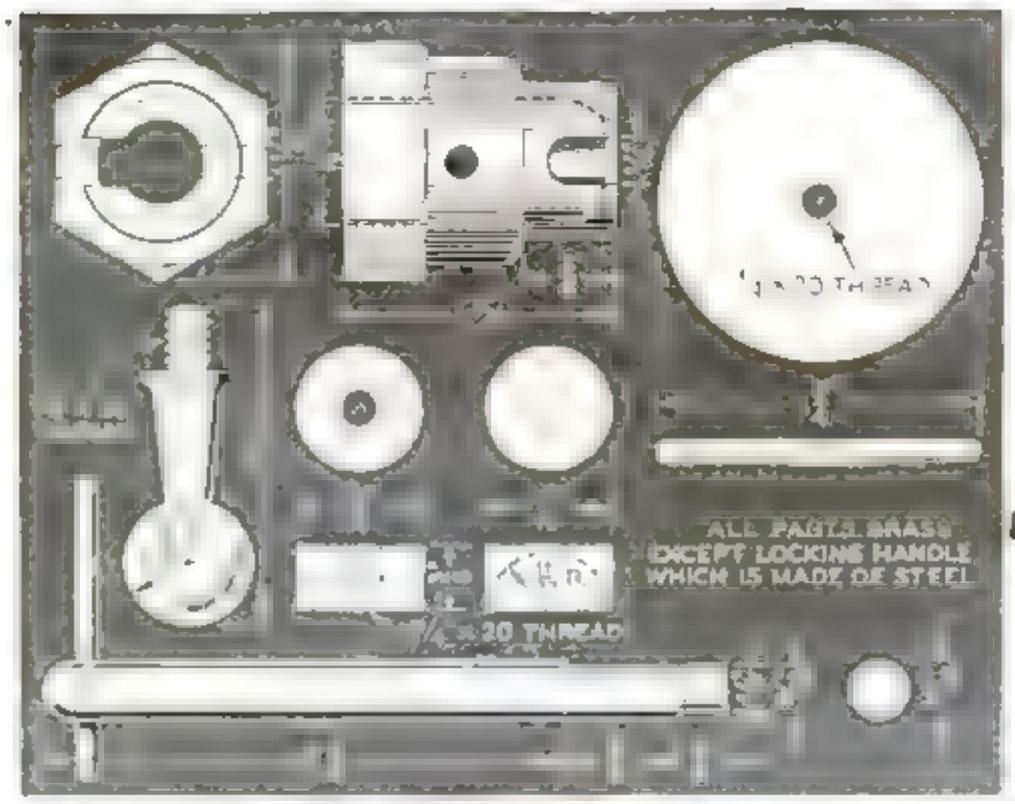
in its club workshop for two days. First prize was won by W. H. Slayton for his walnut radio cabinet; second prize, G. A. Spaulding, carved end table; third prize, M. L. Eggleston, inlaid drawing table; honorable mention, R. D. Brownson, Talbot McGar, Harvey Hansen, and F. L. Strong. The club also held an exhibition in a department store in connection with a model display. Twenty-eight members joined recently. L. J. Larcom spoke on spray and varnish finishing.

Judges announced for the third annual display contest of the *LeRoy (N.Y.)* Homeworkshop Club are Louis W. Steuber, Jacob Fischer, Frank Kurtz, Frank Hall, Arch Creiger, and Henry Thomas. The committee consists of Richard Hutchinson, chairman, Robert H. Howard, Dr. R. L. Skinner, Paul Wirsing, Ernest Curtis, and H. L. Canfield. At a recent meeting L. R. Ferguson talked about dry ice.

Jack Wilcox gave a painting demonstration before the Town Hall Homeworkshop Club, *Ottawa, Ill.* W. E. Nyeland was elected librarian . . . A sailboat and several tents for a summer camp are being made by the St. James Workshop Club, *Montreal, P.Q., Canada.* Many of the members have taken up photography . . . A second club in the same city, *(Continued on page 98)*

Nonslip Tilt-Top Head

FOR CAMERA TRIPOD



Details of parts for the tilting head. It is easy to adjust, yet holds a camera firmly

Below, the completed head attached to the tripod. Note the very durable construction

Boring the body and, right, the machined parts. The project is an interesting one for those who own a lathe

PHOTOGRAPHERS who own a bench lathe will find the construction of this tilt-top tripod head a pleasant evening's diversion. The head is larger than commercial ones and will hold large cameras as well as miniatures very firmly.

The body is turned from round or hexagon brass and bored all the way through except for the last ⅛ in. where the ball seat is formed. The tool is ground to the correct radius of the ball before starting to bore. The outside is then cut down at that end so the wall is a full 1/16 in. thick. Smooth the part nicely, round the corners with a fine file, remove it from the lathe, and file the slot in the side, which enables the camera to be held in a vertical as well as a horizontal position.

Make the head from brass rod with the ball on one end and a ¼-in.-20 thread on the other. A template of thin brass, copper, or celluloid will have to be made to the exact radius of the finished ball. Just keep cutting the ball with a hand tool a little at a time until the template will fit in any position.

The locking handle is of steel. The cam is turned on the end by throwing the rod off center in the four-jaw chuck. Polish with fine emery cloth. The plug for the bottom is tapped to take the tripod screw (¼-in.-20) and is held in the body by three No. 6-32 machine screws, countersunk. The little cup that locks against the ball should be turned so that it fits snugly around the ball. The round washer is ⅛-in. thick brass sheet, turned to diameter.—EARL ENSIGN.

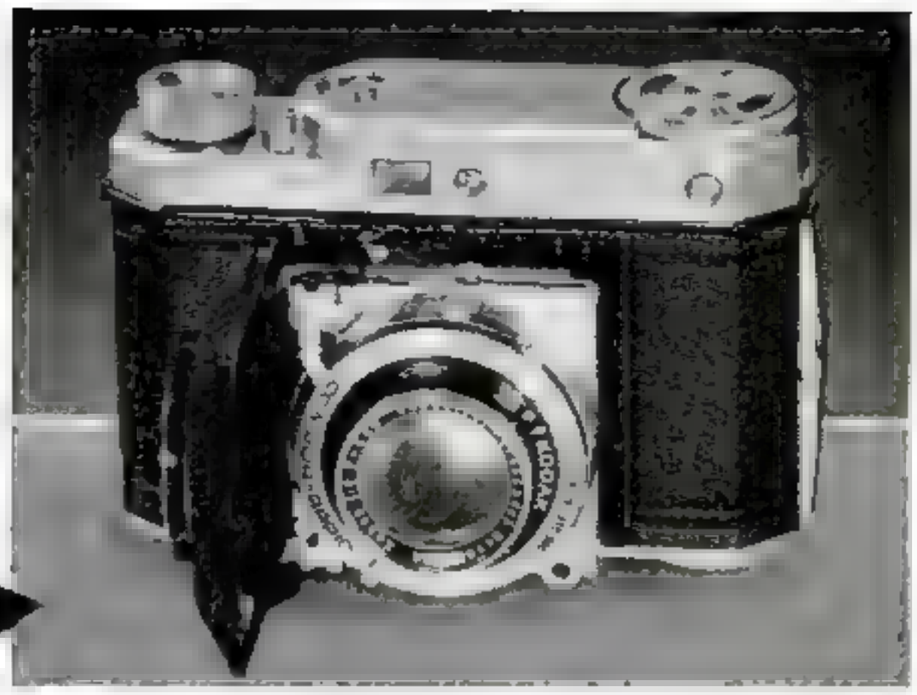
Adhesive Tape Lifts Glass

IF NEGATIVES are sandwiched between sheets of glass for projection printing, considerable time can be saved, and finger marks prevented, by attaching a small tab of adhesive tape to the upper glass. This affords a grip for raising the glass as illustrated.—K.L.R.

Clothes Dampener Washes Prints

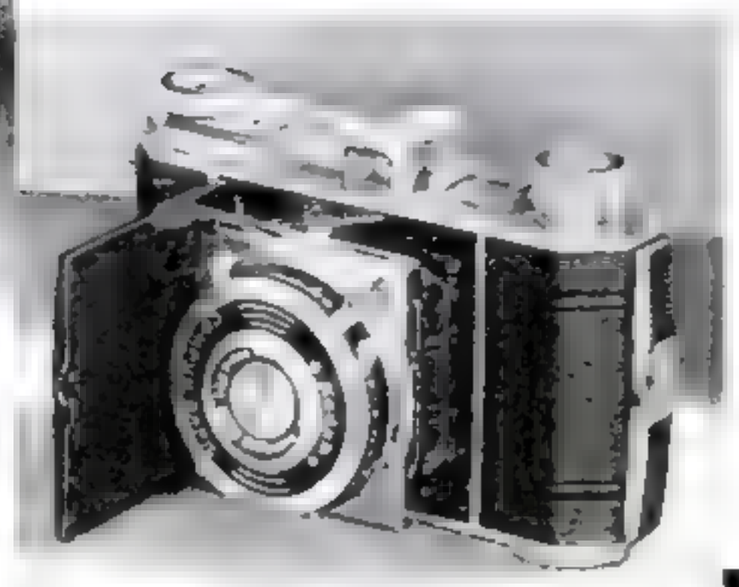
HOME-BUILT washers for photographic prints often have such a strong stream of water that it causes occasional blisters and the breaking of the paper. If an ordinary five-cent perforated clothes dampener is attached to the water hose, it can be used to flush the prints gently and keep them in motion. Wired to a spring clothespin, the improvised washer can be clipped to the edge of a tray or tank.—W.K.

Eastman's "Miniature" Family



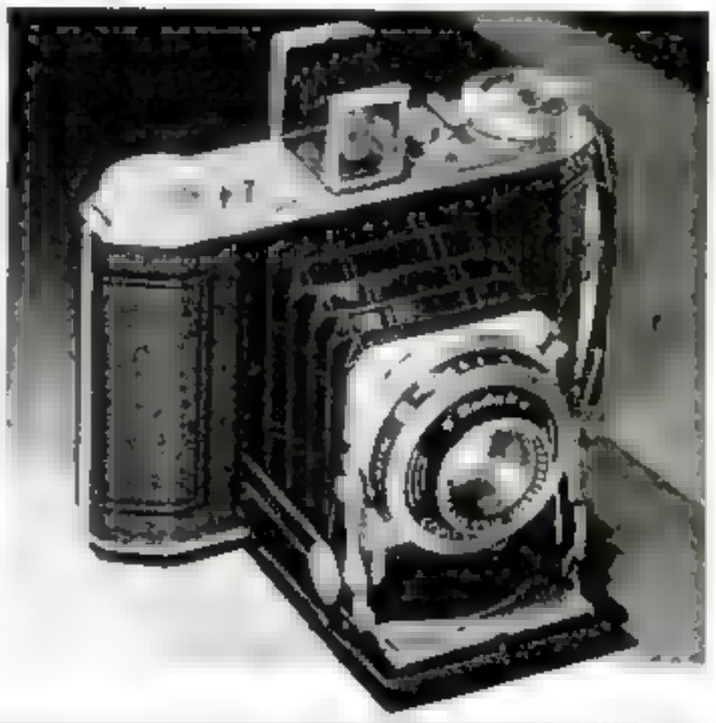
KODAK RETINA II . . . Choice of two extra-fast lenses—anastigmat *f*.2.8 or anastigmat *f*.2.0. Compur-Rapid shutter (9 speeds, 1 to 1/500). Coupled coincidence-type range finder. Body shutter release. Double-exposure prevention device. Automatic exposure-count dial. Depth-of-focus scale. Kodak Retina II, *f*.2.8, $115; Kodak Retina II, *f*.2.0, $140. Prices include sportsman's field case.

KODAK BANTAM SPECIAL . . . Lens, Kodak Anastigmat EKTAR *f*.2.0, extra-fast, super-corrected. Shutter, Compur-Rapid, 9 speeds to 1/500 second. Built-in coupled range finder of the split-field military type finds the range and focuses in one operation. Film-centering device locks film accurately in position for each exposure. New low price, $87.50, includes field case.



KODAK RETINA I . . . the famous original Retina, now equipped with the new, ultra-precise Kodak Anastigmat EKTAR *f*.3.5 lens. Shutter, 1/500 Compur-Rapid. Film-measuring mechanism. Exposure counter. Depth-of-focus scale. Enclosed direct-view finder. Special plunger release. Bracket for Kodak Pocket Range Finder. Price, $57.50.

Only EASTMAN makes the KODAK



KODAK DUO SIX-20 (Series II) . . . The miniature that takes album-size pictures (1⅝ x 2¼). Lens, the brilliant Kodak Anastigmat *f*.3.5. Shutter, 1/500-second Compur-Rapid. Eye-level finder frames action—makes it easy to follow. Body shutter release minimizes danger of camera movement. Bracket for Kodak Pocket Range Finder. Price, $57.50.

LOAD WITH A WIDE RANGE OF BLACK-AND-WHITE FILM

Kodak Retina I and Kodak Retina II load with Kodak "SS," Panatomic, Super X, and Infra-Red Film; Kodak Bantam Special, with Kodak Panatomic and Super X; Kodak Duo Six-20, Series II, with Kodak Verichrome, "SS," and Panatomic.

ALSO LOAD WITH KODACHROME (FULL-COLOR) FILM

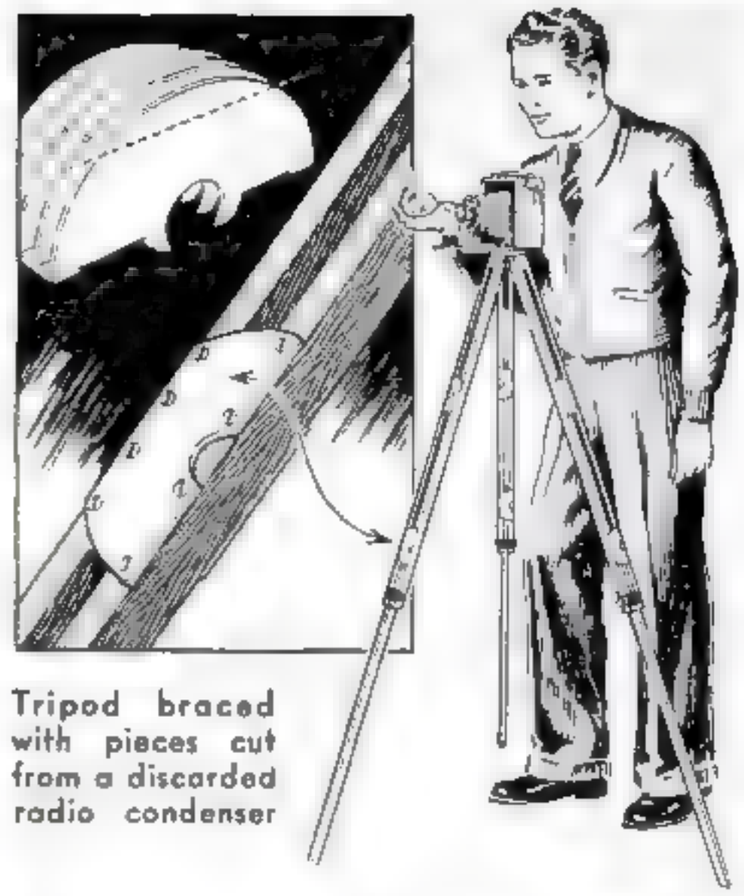
Kodak Retina I, Kodak Retina II, and Kodak Bantam Special also load with Kodachrome Film for gorgeous full-color transparencies. These may be viewed as they are, or mounted in slides for large-size projection with Kodaslide Projector. Your dealer will be glad to demonstrate for you Eastman's miniatures, and to show you examples of their brilliant work in both black-and-white and full-color Kodachrome. . . . Eastman Kodak Company, Rochester, N. Y.

KODASLIDE PROJECTOR . . . Ideal means of projecting mounted Kodachrome transparencies. Built to precision standards. Yields big images of unsurpassed over-all clarity. With 8-foot cord, switch, plug, 4⅞-inch lens, $48.50.

Unloading Miniature Camera Roll Film

IT MAKES anyone impatient to wait until the last shot is taken with a thirty-six exposure miniature camera. You can overcome this by cutting the roll approximately in half after about fifteen pictures. Go into a dark room, wind the film knob one extra turn, open the camera, and cut the film apart. Unwind the used portion until you reach the long loading tongue and cut this off, together with an inch or so of full-width film. Put the used part of the film into a regular film can and seal edge with tape. Fasten the tongue end to the end of the unused film that projects from the cartridge. Care must be taken that the perforations match perfectly at the joint.—CARL FROEN.

Fasten the tongue to the unused film with cellulose tape, or splice it with cement



Tripod braced with pieces cut from a discarded radio condenser

Speeding up Your Film with Mercury Vapor

AMATEUR photographers who wish they had a camera with a faster lens may now gain the same results with their present camera by hypersensitizing their film. By a method recently developed, this process becomes cheap, simple, and sure. All that is required is a little mercury and a few wide-mouthed bottles.

Mercury hypersensitizing will increase the speed of any amateur film from 50 to 150 percent. With an average increase of 100 percent, your box camera with its F/11 lens can do the work of a camera with an F/8 lens using untreated film, while the F/2 lens of your minicam is boosted to F/1.4.

A few drops of mercury are placed in a cardboard pill box which has holes in the top. Then the pill box and film are sealed tightly in a black-painted mayonnaise jar

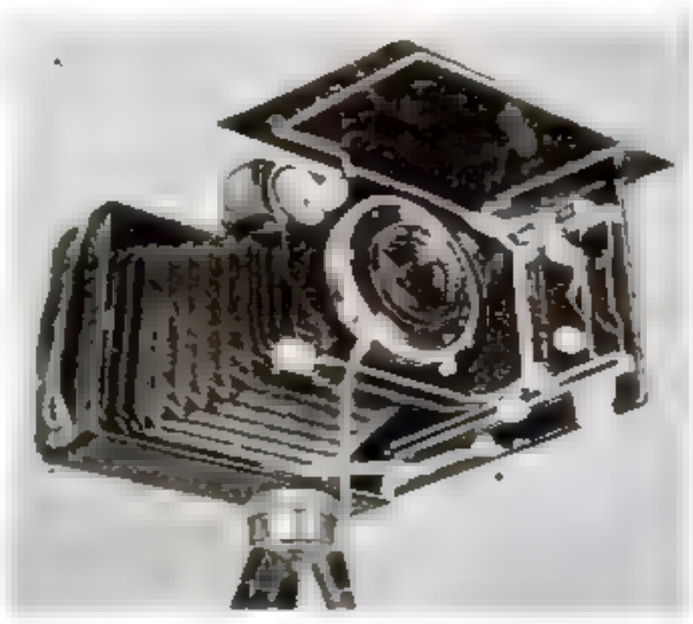
An amazing feature of the process is that film may be treated either before or after exposure, the greatest improvement in speed occurring when treated at the latter time. Another feature is that film may be treated in tightly wrapped rolls.

Large cold-cream jars or half-pint mayonnaise jars are excellent containers for the processing. To hypersensitize your film without loosening it on its spool, these jars may be used just as they are. For loose film, they should be given several coats of opaque paint on the outside. Be sure to cover every spot. If the cover of the jar is metal, the inside of this should be given several coats of either shellac or varnish.

To treat a roll of film, put a few drops of the mercury in a cardboard pill box that has several small holes cut in the top. Place this box in the bottom of the jar and stand the roll of film upon it. Now put the cover on the jar, and seal it with several turns of opaque tape. Loosely wrapped film will be fully hypersensitized in about thirty-six hours at ordinary room temperature. Tightly wrapped film should be left from six to eight days. By providing a number of containers, each labeled with type of film and date, the processing may be staggered so that the required number of rolls will be ready just when you want them. The effects of the process last in full force for about three weeks. Development should be carried through in the ordinary way.—K. M. S.

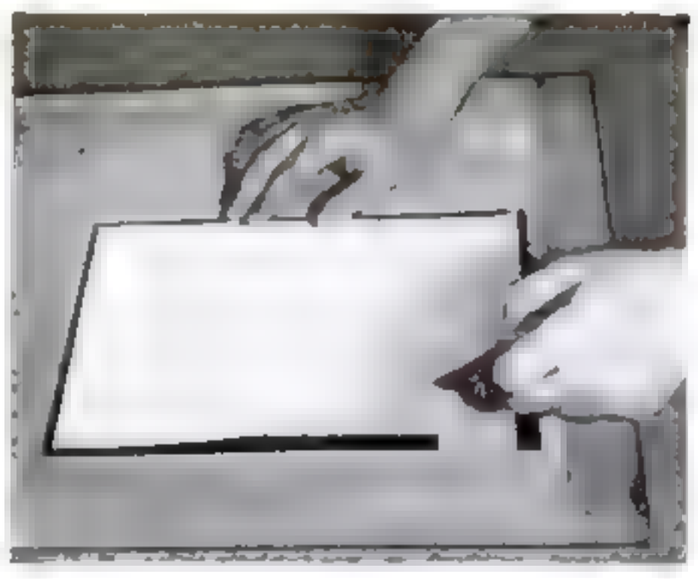
Improvised Sunshade for Folding Camera

A SUNSHADE for an ordinary cut-film or film-pack camera, when used in a horizontal position, can be provided by turning the wire view finder as shown below and laying the film slide across it.—PAT MACDONALD.



Aluminum Plates Stiffen Light Wooden Tripod

LIGHT wooden camera tripods that vibrate excessively can be stiffened by fastening metal braces across the upper sections as shown. Aluminum plates taken from an old variable radio condenser are excellent for this purpose and add very little weight to the outfit.—MERLE TERRILL.



Enlarging Paper Held with Adhesive Tape

WHENEVER a photographic enlargement has to be made that requires the full area of the enlarging paper, it is difficult to hold the paper perfectly flat. Covering it with glass is not entirely satisfactory, as all the flaws in the glass are shadowed on the paper and sometimes a double image may be produced. A better method is to glue photographic tape with the adhesive side upward to an old drawing board or other suitable flat surface in the form of a rectangle large enough to enable the paper to be stuck down as shown. A gap of several inches is left at one corner so the paper may be lifted easily. No trace of adhesive remains on the back of the paper.

Eyedropper Used as Oiler

OUT-OF-THE-WAY bearings in typewriters and other small machinery can often be oiled more conveniently by using a small suction-type eyedropper than a conventional oil can.—E. T. ROBINSON.

Fishline Spider Keeps Tripod from Spreading

TO KEEP a camera tripod from doing a "split," nothing is more effective than a brace made from strong fishline and a few rubber bands. The line, which should be of the type intended for deep-sea fishing, especially if the tripod is a large one, is cut and tied so that it forms a spider having three equal segments of such length that they are stretched

Looped rubber bands pull the cords up out of the way when the tripod legs are folded

to a horizontal position when the tripod legs are spread normally apart. The ends are fastened to the tripod legs by means of small screw eyes or any other convenient method. Some tripods are equipped with loops to take such braces.

Loop rubber bands together until their total length is such that, when fastened between the center of the fishline spider and the tripod-head screw or upper end of one of the legs, they will pull the line up out of the way when the tripod legs are folded together. The ends of the spider can be equipped with snap hooks, paper clips, or any device that will permit quick attachment or removal.—W. E. B.

Varnish Remover Cleans Clogged Sanders

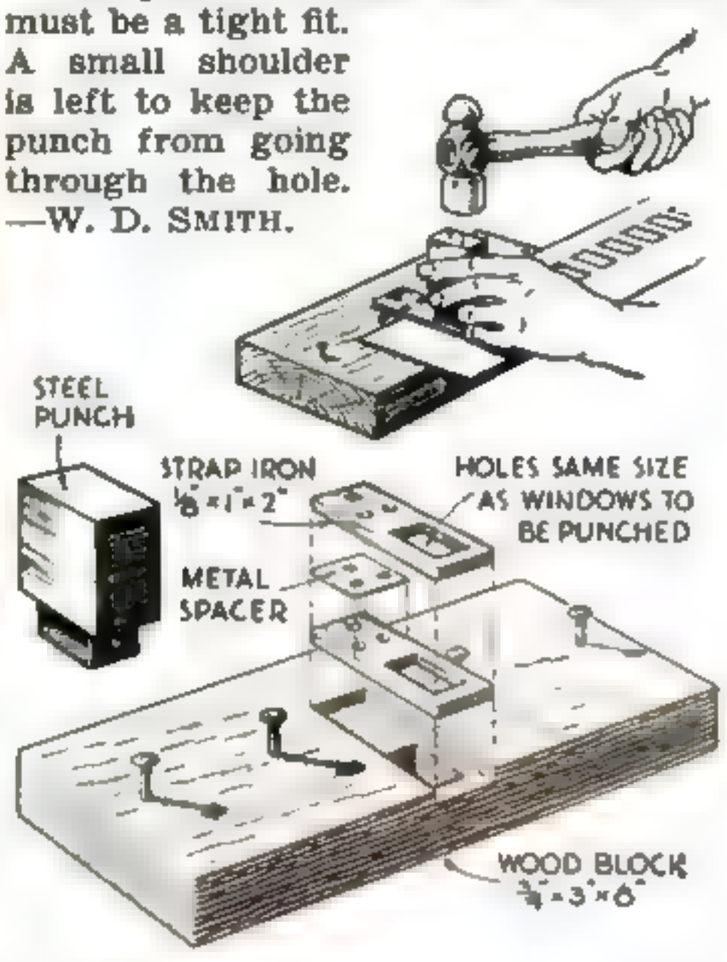
OWNERS of belt and disk sanders often find the abrasive surface clogged with pitch and powder. This renders them useless long before the abrasive has worn off. I have found that applying prepared varnish remover will dissolve the gum or pitch, which may be removed easily with a stiff wire brush. This treatment has been used as often as four times on the same belt before discarding it.—DONALD R. FOSLER.

Punch Cuts Out Windows in Passenger Cars

IN MAKING the cardboard sides for model railway cars of the 00 and H0 gauges, much time may be saved by constructing a punch and die as illustrated. The die consists of two pieces of strap iron about 1 by 2 by ⅛ in. with identical holes drilled and filed in them to the size of the windows. The hole must be the correct distance from the right outer edge of the iron to give the desired spacing between windows.

One of these pieces is set flush in the wooden block as indicated, with a hole below for the punchings. The other piece goes on top with a metal spacer between. The spacer is the same thickness as the cardboard and is placed to serve as a stop, so that each window will be the desired distance from the top of the car. Nails are added as guides.

The punch is filed from steel and must be a tight fit. A small shoulder is left to keep the punch from going through the hole. —W. D. SMITH.



How the punch and die are made and used

Abrasive on Screw Driver Prevents Slipping

IN LOOSENING a tight screw, the screw driver sometimes keeps slipping out of the slot and chewing up the slot. The next time this happens, try dipping the point of the screw driver into some emery or other abrasive powder. If no such powder is handy, dip the point in the grinding dust around your grinder or use ordinary kitchen cleanser.

Flat-Drying Process Paint for Finishing Models

POOR painting probably spoils more scale models than anything else. Amateurs often use high-gloss paints over a surface that has not been properly prepared with the result that every blemish shows distinctly and the whole looks like a cheap toy.

Anyone can now obtain a fine-looking flat finish on models by using what is commonly called "process paint" or "silk-screen stencil paint." It brushes easily, dries flat, covers well, and is very durable. You will not find this in ordinary paint stores, but it may be purchased at any sign painters' supply house or from the larger nationally known paint stores, as well as by mail from certain specialty paint dealers. The price range is generally from $1.25 to $1.75 a quart.

Do not follow the directions on the can, because they are intended for silk-screen stencil work, but thin the paint approximately twenty-five percent with mineral spirits, painters' petroleum, or gasoline. It dries tack free in about thirty minutes, and is hard in from two to four hours.

Be sure to get flat-finish process paint, because it is also available in a gloss finish, lacquer finish, and synthetic enamel finish.—C. A. VOELCKEL.

Model Railway Materials

A HEAVY rubber band makes an excellent belt for transmitting power from one axle to the other in the power trucks of MU or interurban models. Small pulleys to fit the axles may be obtained from discarded drapery fixtures, where they are used to carry the cords for traverse draperies. With a little reaming, the pulleys can be made a press fit on the axles.

Serviceable worm-and-pinion sets for use in light models may be obtained from children's structural building sets or purchased direct from the manufacturers at much lower cost than the worm-and-gear sets usually used in models.

How To Free Tight Journals on Model Railway Trucks

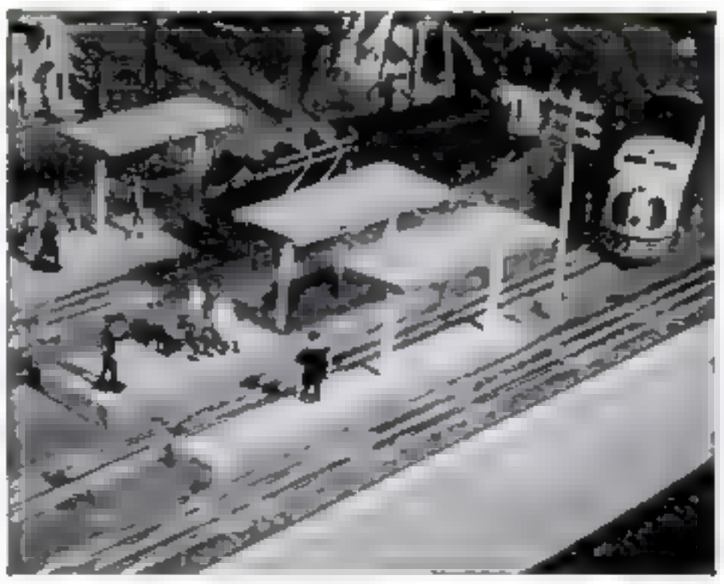
TIGHT truck journals are sometimes a source of trouble to model railway engineers, but they may usually be remedied by holding the wheels against a rapidly moving belt. The high speed quickly loosens the bearings.—A. F.

Three Hints on Using Soldering Coppers

WHEN a considerable amount of solder has to be deposited on work that is more or less inaccessible, it pays to file a reservoir groove the full length of one of the faces of the soldering copper. Extend the groove right to the point, and tin it well.

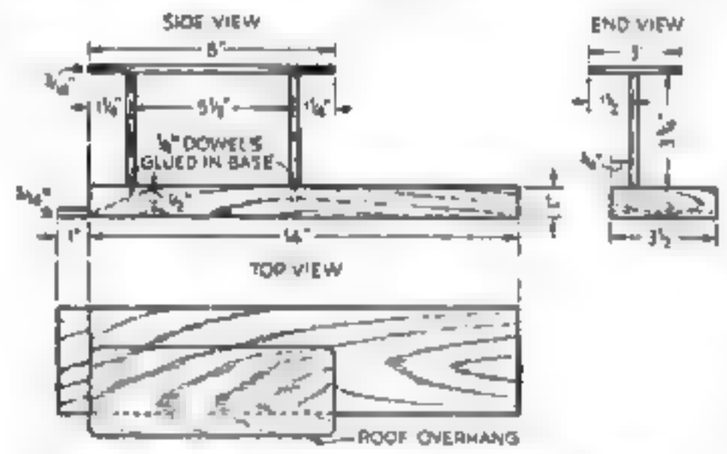
Electricians who frequently have to solder wires in awkward overhead positions can save themselves trouble by using a bit with only one face and bevel tinned. It should be kept for this special purpose. The solder will not run all over as is the case where all four faces of the point are tinned.

Those who heat their soldering irons over charcoal, gas, or gasoline can remove the oxidation so the bit will heat more rapidly by dipping the copper while hot in a solution of ½ oz. powdered sal ammoniac dissolved in 1 qt. water. Keep this in an earthenware jug or crock.



Simple Model Railway Loading Platforms

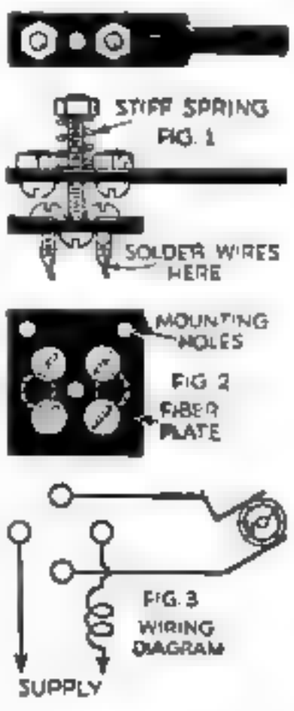
SCALED for "O" gauge model railway track, these loading platforms supplement the main passenger stations to form freight depots or train sheds. If necessary, the base and roof can be cut in the shape of an arc to fit around curved portions of the track, or several of the platforms may be placed between the tracks to create a terminal shed. In the latter case, extend the roofs so they touch to give the impression of a continuous roof, or use one large roof. Gray paint, sprinkled with sand while still wet, will imitate cement on the base and columns. Use green or brown paint on the roof.—C. ELMER BLACK.



Three views of a platform for "O" gauge, although length and width may be varied

Switch for Reversing a Model Locomotive

THIS reversing switch for model-railway use requires a piece of fiber with four roundhead screws (Fig. 2). The lever is cut from the same material and carries two roundhead screws (Fig. 1). A fairly stiff spring is used on the center bolt. The screwheads on the lever must each contact two screws in the plate. The method of wiring is shown in Fig. 3. If the headlight is connected directly to the third-rail shoe when the switch is in midposition, trains can stand with the lights burning, and a flip of the lever 45 deg. will set the train in motion. If small screws are used, the switch will fit in a cab. —JAMES M. BOWLES.



Homemade Flexible Shaft Does Fine Work

Chasing a silver ring with the unit, which is a homemade copy of a dentist's drill

THIS dentist's type flexible-shaft grinder is a useful tool for model making because it operates at high speed with little vibration. Small grinding wheels, sanding disks, and burrs may be obtained from a dental supply house, or your dentist will perhaps give you some of his discarded ones.

The writer has used the outfit illustrated for drilling, chasing, grinding, and polishing in connection with jewelry work; for grinding small dies; for carving, drilling, and other fine work on ship models, and as a tool-post grinder on a small lathe. Gunsmiths also would find such a unit valuable.

Materials. Small pin vise with chuck taking a ⅛-in. drill (maximum); 2 ft. of ¼-in. flexible metal conduit; 3/32-in. flexible core from an auto speedometer shaft; brass rod.

Vise. Cut handle to desired length and ream out burr. Insert short length of steel rod in the chuck, tighten chuck, and center piece in lathe. Hold the hollow stub of the handle with the tailstock center. Turn down shank and polish to turn in brass bearing at end of flexible conduit. Fit one end of cable snugly into hollow stub handle and "sweat" with solder.

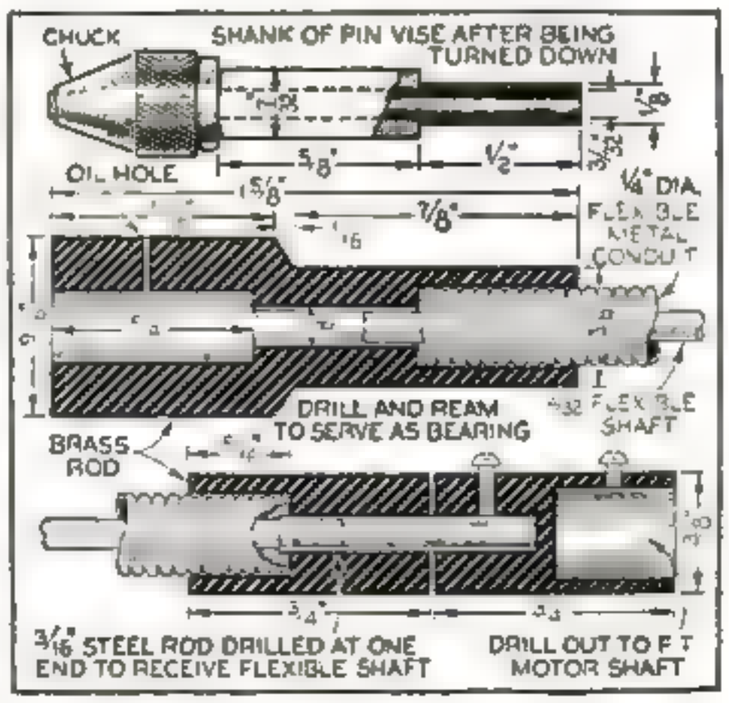
If a ball-bearing unit is desired, obtain a used "hand piece" from a dental supply house and substitute it for the remodeled pin-vise assembly.

Fittings. Turn from round brass stock a fitting to serve as a bearing for the finished chuck. Make outside any convenient size and shape to hold in your hand. Drill and ream one end to receive the chuck unit; drill the other end to receive about 1 in. of the conduit. Fit this brass piece over the conduit and solder.

Make brass collar for other end of conduit. Note that a short length of steel shaft is sweated to the tail end of the cable. This rod must not be too large to go through the chuck bearing, as the unit is assembled by feeding the cable in through the chuck end. Also make brass collar to fit over motor shaft and receive the projecting end of the steel rod.

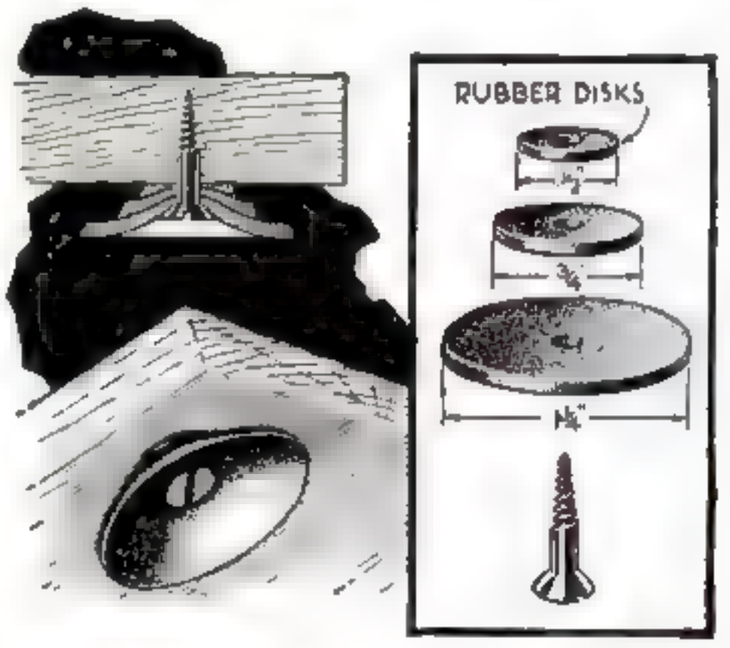
Chuck and cable before being inserted in housing. In center are some of the tools

Assembling. Rub the cable with graphite paste and assemble as shown. The motor used in the original is a 1/10-h.p. variable-speed motor with a maximum speed of 6,000 r.p.m, which was purchased secondhand for $1.50. An alternative method is to chuck the driven end of the cable in your lathe. High speed is best for grinding operations.—C. K. FANKHAUSER.



The remodeled pin vise, the brass bearing, and brass collars for use at the motor end

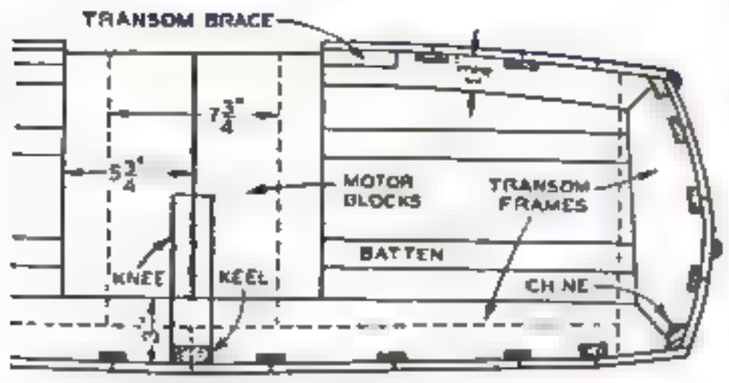
Rubber Vacuum Cups Keep Pastry Board in Place



PASTRY boards and other articles that are to be used on smooth surfaces may be prevented from slipping by providing them with vacuum-cup feet, as shown. Each foot consists of three disks of rubber cut from an old inner tube and screwed to the board.

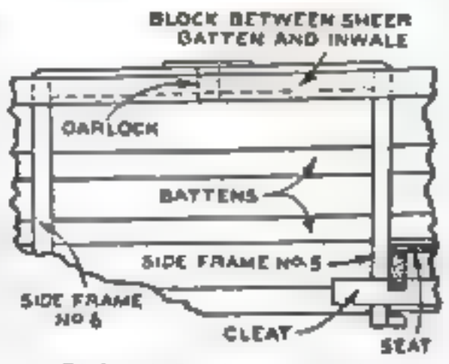
New Fisherman's Boat

(Continued from page 61)



Cross Section at Transom

Above is a diagram showing the relation of all parts at stern. The dotted lines indicate parts on the outside. Right, an inside view of side at the rowing seat



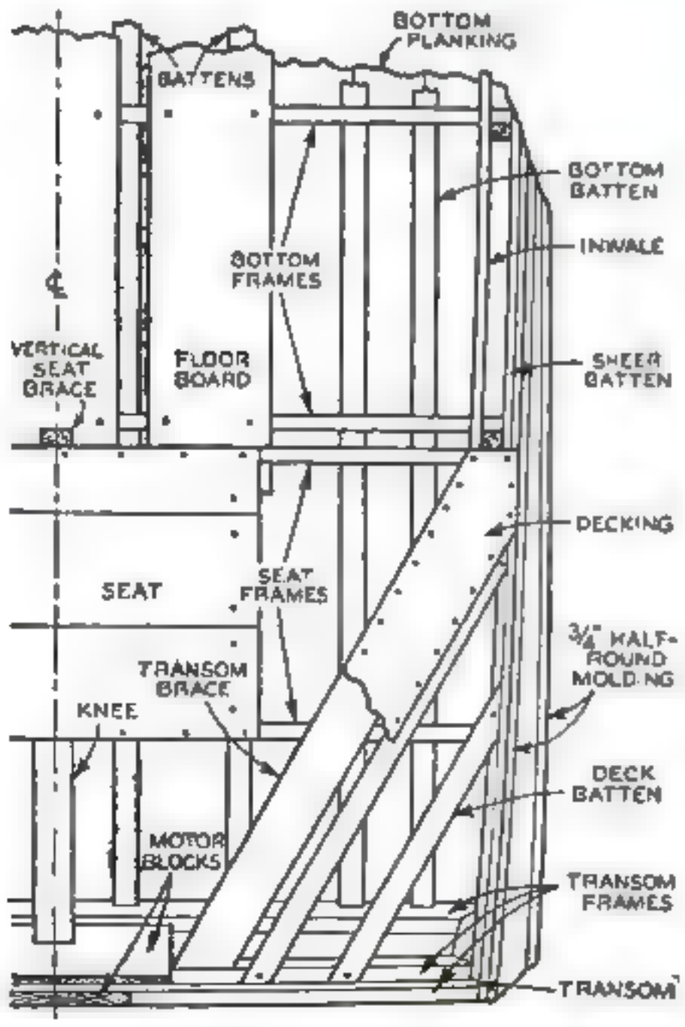
Side at Stations 5 and 6

seat may be made removable by notching the seat frames over a cleat screwed to the side frames.

The entire hull should be well sanded before the priming coat is put on and, after the priming coat is dry, all screw holes covered with putty. The hull should have at least two coats of marine enamel, or else flat paint covered with a coat of spar varnish. The deck, seats, and trim, including the sheer and fender molding, can be given a natural finish with two or more coats of spar varnish. To mark the water line, set the boat level on an even floor and mark around the hull 5 in. up from the floor.

The sheer and fender molding should be ¾-in. hardwood screwed to the frames and battens with 1¼-in. No. 7 oval-head brass screws. A strip of ½-in. brass or aluminum should be used to protect the stem.

A fin about 3 in. deep by 6 in. long will be necessary to prevent skidding on turns if a motor of over 6 h.p. is to be used. The fin should be bolted to the keel between frames Nos. 4 and 5.



Assembly view looking down on hull at stern

Learn to Sail on Your Dining Table

(Continued from page 38)

the wind. To prevent the possibility of an accidental jibe, good sailors generally steer their boats before the wind so that the breeze comes over the stern slightly on the opposite side to that on which the mainsail is riding.

JIBING, coming about, and all the other maneuvers of your model boat on the table have been done by hand, by actually taking hold of the boat and moving it from one position to another. In an actual sailboat, of course, the rudder does this steering job. Study how your model rudder acts as you twist the tiller back and forth and you will note that it works just opposite to the manner of an automobile steering wheel.

If you want to turn a boat to port, the left side looking toward the front end or bow, you swing the tiller to starboard, the right side, and vice versa. It is well to remember, however, that if a boat is drifting backward, the action of the rudder is just the reverse. And if you ever sail a real boat and become confused about the steering or setting of the sails, simply turn the tiller toward the sail. This will always swing the boat into the wind and bring it to a standstill.

One vital difference between table-top and actual sailing is in knowing the exact direction of the wind. At home, you can have the wind blow from any direction merely by moving the fan, but under actual sailing conditions, you will have to adapt the boat and its sails to the prevailing wind. Thus it is extremely important to know from just what direction the wind is blowing, and to keep on the lookout for sudden changes.

SAILORS sometimes fasten a pennant to the truck, or topmast part of the mast, or attach bits of yarn to the shrouds at the side of the mast, to show wind direction. But old salts just face in the general direction of the wind and turn their heads from side to side until the hum of the air passing both ears is of equal intensity. Then they know they are facing directly into the breeze. Try this in front of your electric fan. If the noise of the motor is not too loud, you should soon get the hang of this trick.

By the time you have become proficient in maneuvering your model boat on its miniature sea, you will have learned most of the fundamentals of sailing. The practice indoors enables you to visualize exactly what is happening in each maneuver you make when you begin handling a full-size craft on real water. By becoming a table-top mariner first, you will save time, and avoid dangerous mistakes.

Cleaner Air To Breathe

(Continued from page 77)

soda water sparkle and fizz. Your exhaled breath contains about four or five percent of it. In the small proportions ordinarily encountered, in fact, carbon dioxide is entirely harmless. When people are breathing in a closed chamber like a submarine or a stratosphere-balloon gondola, however, containers of soda lime (a mixture of caustic soda and quicklime) must be provided to absorb it, or it would rise to such a percentage as to endanger life. This is because a high concentration of carbon dioxide in the atmosphere interferes with the elimination of the same gas as a waste product of our bodies.

AIR that you exhale is about 140 times as rich in carbon dioxide gas as the atmosphere is, and a simply constructed bit of apparatus will demonstrate the difference in a striking way. Obtain a pair of similar flasks and place in each one an equal quantity of clear limewater. This is prepared by shaking several grams of lime with about 100 cubic centimeters of water and filtering the resulting solution. Fit the flasks with two-hole stoppers, and join them with tubing providing a T connection at the center. Attach a piece of rubber tubing to this T connection to serve as a mouthpiece. Fit one of the flasks with a piece of glass tubing that dips below the surface of the limewater, and the other with a rubber-tubing outlet closed with a small cork and slit along the side with a razor, to form a one-way valve.

Now, when you suck through the mouthpiece, outside air will bubble through the limewater in the first flask. When you exhale through the mouthpiece, your breath will bubble through the limewater in the second flask. Without further manipulation, the operation of the apparatus is entirely automatic in directing the air streams through the proper vessels.

TRY breathing continuously, in and out, through the rubber-tubing mouthpiece. Soon you will notice that the limewater in both flasks is turning milky. This is due to the precipitation of calcium carbonate (precipitated chalk) by the reaction of the carbon dioxide with the limewater. The liquid in the second flask will be much the milkier of the two, plainly demonstrating that there is a far higher percentage of carbon dioxide in your exhaled breath than in the surrounding atmosphere.

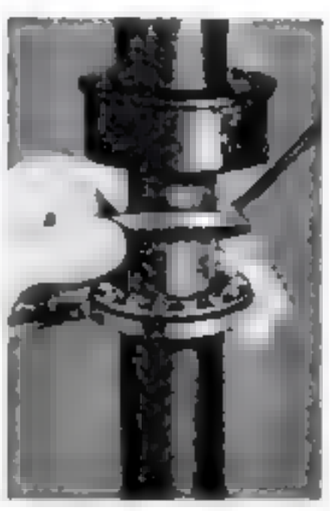
An easy way to obtain carbon dioxide for chemistry experiments is to put a chunk of dry ice (frozen carbon dioxide) in a bottle and let it "melt."

Wind-Driven Generator Supplies Current for Summer Home

(Continued from page 63)

completed armature with several coats of insulating varnish, allowing each to dry thoroughly.

Mark the field pole pieces so they can be replaced in their original positions; then remove them and the field coils. Make a wooden winding form, the center of which is the same size as the opening in the original field coils. Wind two new field coils in same direction as the old ones, each consisting of 220 turns of No. 20 celenamel wire (approximately 1¼ lb. will be needed altogether). Connect exactly like the original field coils. Wrap coils with cotton tape and cover with insulating varnish or shellac. Replace the pole pieces and new coils, and connect ends to same brush and ground terminals as before.



The housing raised to show the bearings

Shape the end of a 1-in. pipe (long enough to extend below the larger supporting pipe) as in Fig. 10 and mount the generator as shown at Fig. 5. Drive a short piece of 1¼-in. pipe over the 1-in. pipe and solder a metal bearing cover to it. A set of ball bearings and raceway to fit the 1-in. pipe may be picked up in an automobile wrecking yard.

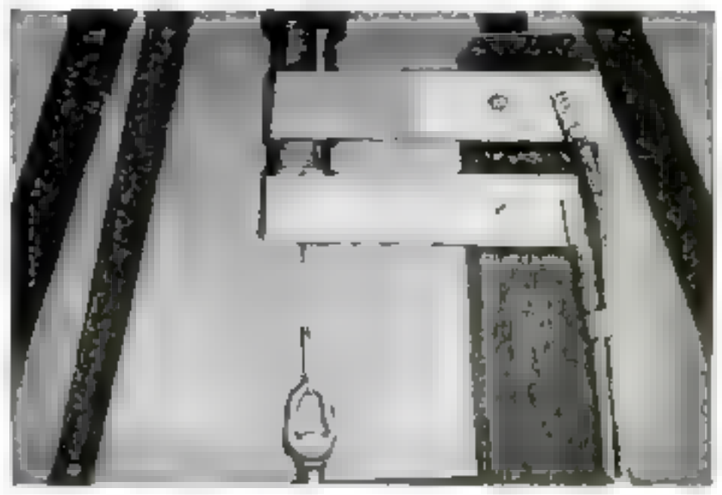
Note that the pipe sizes are trade sizes, not the actual sizes in inches. The outside diameters of pipes may vary somewhat, so it is advisable to select pieces that will make a fairly snug fit when one is placed inside the other.

The collecting rings and brushes are shown at Figs. 10 and 11. The generator should be placed as high as possible, clear of surrounding objects. The mounting tower may be either wood or angle iron.

An adjustable vane is provided (Figs. 3 and 5), so the generator will not be injured by strong winds. The tension on the vane may be set so the generator speed will be nearly constant in varying wind speeds, because as the wind increases, the vane tends to fold at right angles to the propeller, and this moves the propeller away from the wind.

To stop the generator, the vane is pulled around by a flexible metal cable so it is at right angles to the propeller. The lower mounting bracket for the vane is shown in Figs. 6 and 7.

The propeller is cut from 20-gauge galvanized steel 3 ft. square (Fig. 8).



Collecting rings and brushes at bottom of pipe support. Connections are No. 10 wire

It is bolted to the generator pulley. The wire reënforcing ring is threaded through the holes, and the ends are bolted or brazed together. Bend the blades to slant about 30 deg.

Two No. 10 wires are brought out from the brushes on the tower to the cut-out coil and connected as in Fig. 12. The lower brush is connected to the generator terminal, which is the positive pole. At Fig. 5 it will be seen that the generator terminal passing through the vane-support bracket is thoroughly insulated with fiber washers from the surrounding metal.

It is advisable to include an ammeter in the circuit (Fig. 12); this may also be obtained from a wrecking yard.

Small Machine Belts Laced with Copper Wire

THE efficient operation of home workshop machines depends to a greater extent than generally realized upon the belts. While endless belts are excellent, they soon stretch so that proper speed cannot be maintained unless some arrangements are made to tighten them. Laced belts are the alternative, but many amateur mechanics seem to find it difficult to do the lacing. It is really a simple process, especially if No. 22 plain copper wire is used. This wire, which can be purchased in spools at any hardware store, is quite satisfactory for small belts.

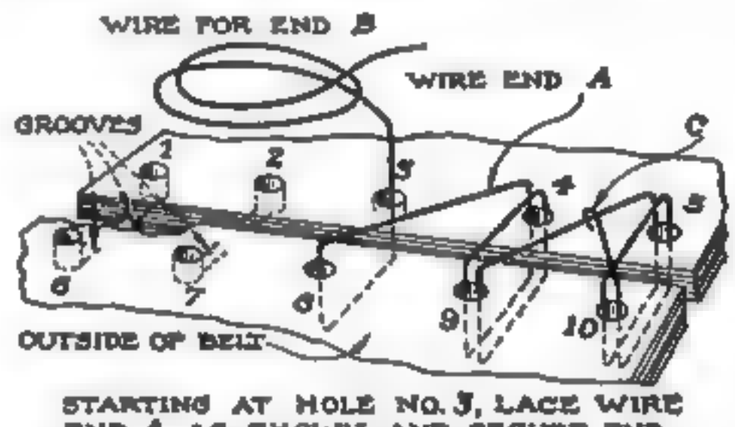
Put the belt over the two pulleys where it is to be used and pull moderately tight. Mark with a try-square where the joint comes, and cut off the belt. Then file off the point of a 2½-in. (eightpenny) finishing nail to form a punch for making the holes. A belt punch will do this work, but it is difficult to obtain one that will make a small enough hole.

The two outside holes should be about ¼ in. in from the edge of the belt; the remaining holes are spaced about ⅝ in. apart. When they have been punched, run a groove from each hole to the end of the belt on the pulley side. This groove is for the wire to lie in so that it will not come in contact with the pulley.

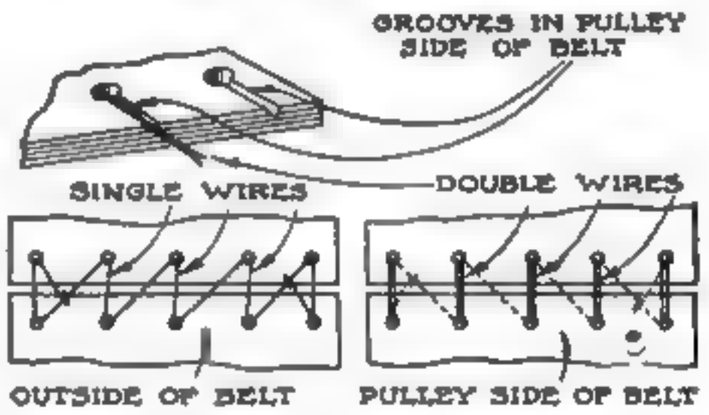
Cut off a piece of the copper wire about five times as long as the width of the belt and run it halfway through hole *3*. Then run the end marked *A* up through hole *8*, down through *4*, up through *9*, down through *4*, up through *9* again, down through *5*, up through *10*, down through *5*, and up through *10*, and loop the end *C* around the cross wire between holes *5* and *9*. Lace end *B* down through *8*, up through *3*, and then through the remaining holes in the same way.

Make sure that the wires lie side by side on the inside. If you allow them to cross over one another, the pulley will wear them out. After the ends have been curled under as at *C*, lay the belt, underside down, on an iron block and tap the joint lightly with a hammer. A belt laced in this manner runs without bumping and will last longer.

Bear in mind that the hair side of leather belting should be run against the pulley.—R. A. HILL.



STARTING AT HOLE NO. 3, LACE WIRE END A AS SHOWN, AND SECURE END AT C. THEN LACE WIRE END B (TO THE LEFT) IN THE SAME MANNER



Lacing the belt is a simple operation if the diagrams above are followed carefully

A Quick Way of Making Good Ground Glass

WHEN a sheet of ground glass is needed, first obtain a piece of 2-in. plank a little wider and longer than the glass to be ground. One surface must be planed perfectly smooth. Set the glass (old glass photographic plates with the emulsion washed off are good for this purpose) on the plank and inclose with strips of wood slightly thinner than the glass.

Take a piece of the same plank as large as the first piece and cement sheet rubber (an old inner tube will serve) to the smooth surface; then provide an edging of wooden strips, put on so that it extends just a little beyond the rubber face, and attach a wooden handle to the center of the back. Dust a little emery powder on the glass and sprinkle with a few drops of water. Dampen the rubber face of the upper block and place another sheet of glass upon it. The moistened rubber will hold this glass in place and permit it to be rubbed with a constantly changing motion over the lower sheet.

After about ten minutes grinding, wash off the emery and observe the results. Where an unground patch is seen on either plate, tear off a piece of thick paper, place behind the glass so as to force it forward, and continue grinding.—W. W.

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for Building a Fisherman's Boat

You will have no difficulty in constructing this boat from Blueprint Nos. 344-345

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A few of our many blueprint projects are given below. Our latest complete list will be sent free upon receipt of a stamped, self-addressed envelope.

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Experimenter No. 3, flying airplane, 20½-in. wing spread, 20 in. long, *348A* ..... .50
Freighter, Ocean (14-in.), *271* ..... .25
H. M. S. *Bounty* (8½-in. hull), *254* ..... .25
Liner *President Lincoln* (14¾ in.), *325* ..... .25
Mayflower (24 in.), *83-84-85-R* 1.00
New Bedford Whaleboat (14-in.), *326-R* ..... .50
Privateer *Swallow*, Baltimore clipper, (13-in. hull), *228-229-230-R* 1.00
Racing Yacht *Seascout* (42-in.), *106-107-R* .75
Sovereign of the Seas, clipper ship (20½-in. hull), *51-52-53-R* 1.00
Spanish Treasure Galleon (24 in.), *46-47* .... .50
Trading Schooner (17½-in. hull), *252-253* ... .50
U. S. Battleship *Texas* (3-ft. hull), *197-198-199-200* 1.00

{Construction kits are available for some of these models. See page 11.}

FURNITURE

Bed and Armchair Table, *333A* .25
Bookcase, modernistic, *88* ..... .25
Double-Decker Bed, *277A* ..... .25
Four-Leaf Card Table, *239A* ..... .25
Gate-Leg Table with Round Top, *24* ..... .25
Hanging Wall Cabinet, *280A* ..... .25
Modernistic Lamps (three designs), *93* ..... .25
Reading Tables, Two, *68* ..... .25
Sewing Table, *1* ..... .25
Silverware Chest on Stand, *256A* ..... .25
Smoking Stand, Modern, *238A* ..... .25
Tea Wagon (turning), *13* ..... .25
Telephone Table and Stool, *18* ..... .25
Tilt-Top Table (turning), *140* ..... .25

RADIO SETS

All-Wave Portable Receiver (two tubes, operated by battery), *217-R* ..... .50
Amateur Short Wave Receiver, *155* ..... .25
Amateur Radio Transmitter, *183-184* ..... .50
Five-Tube Short Wave (A.C. or D.C.), *223* .25
Full Electric Headphone Set, *130* ..... .25
One Tube (battery operated), *103* ..... .25
Screen-Grid Set, *109* ..... .25
Short-Wave Converter Unit, *137* ..... .25

MISCELLANEOUS and TOYS

Arbor with Two Seats and Garden Gate, *9* ..... .25
Baby's Crib and Play Pen, *26* .... .25
Garden Trellises, *34* ..... .25
Naval Gun Model (3-in.), Boy's Coat Rack of Indian Design, and Costume Brooch of Sheet Copper, *346A* ..... .25
Portable Microscope Kit, *220* ..... .25
Rowboat Back Rest, Band-Iron Electric Wall or Table Lamp, and Jig-Sawed Garden Figures, *347A* ..... .25
Rustic Settee, *156A* ..... .25
Toy Electric Motor, Softwood Coffee Table, and Scottie Pins, *332A* ..... .25
Turned Costume Jewelry, *275A* ..... .25
Wood-Mosaic Serving Tray and Novelty Wooden Book Ends, *297A* ..... .25

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353 Fourth Avenue, New York

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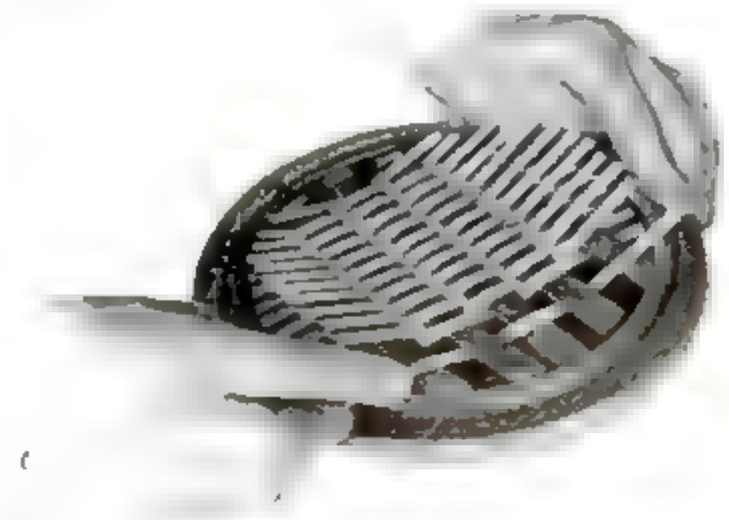
Decorative Baskets of Thin Wood

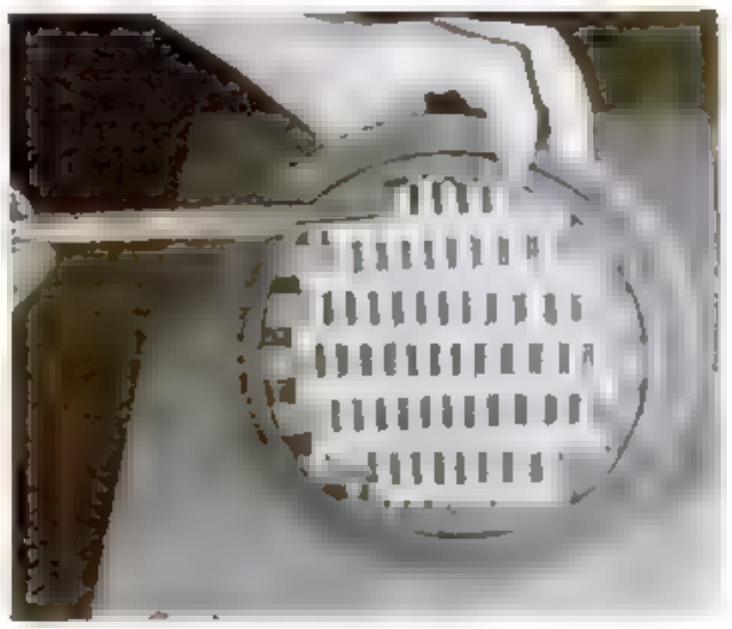
(Continued from page 70)

groove. The weaving strips are 3/16 in. wide and 1/16 in. or less in thickness. These strips cannot be cut in the usual manner of passing the strip between the saw and the ripping fence, because with such small work this process is very dangerous. The following method is safer: The material is first passed through the saw to make both sides parallel. A block of wood is fastened onto the miter gauge so that its end is the required thickness of the strip away from the saw blade. The ripping fence is adjusted so that the material for the strips presses lightly against this block, as illustrated. The miter gauge is then removed, and the material is passed through the saw. As the ripping fence must be adjusted for each strip, it will speed up the process if several pieces of material of the same width are passed through the saw in succession.

The strips are sanded and fastened in place in the groove of the bottom piece with a good grade of glue. There



Weaving the top. One end of each cross strip is left unfastened for this purpose

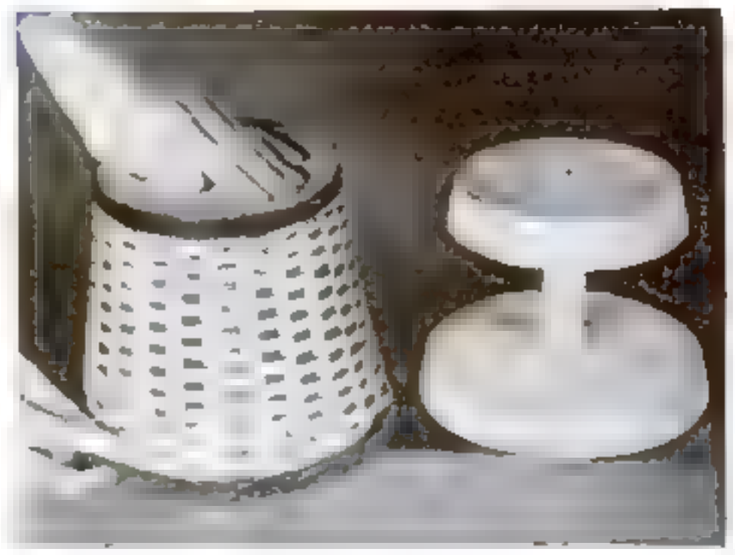


Cutting surplus ends from weaving strips

should be an even number of these strips. The space between each strip at the bottom should be between ¼ and ⅜ in.

To retain the correct shape of the basket while it is being woven, it is best to use a form. This consists of two disks of wood turned to fit the inside of the basket and separated by a spindle. These disks are turned slightly small to allow for the weaving strips.

The weaving strips are soaked overnight in water. With the form in place, one end of the first strip is placed on the inside of one of the uprights. Working



Gluing the strips into the upper ring. At right is the form used in the construction

around the top of the form, place the remaining part of the strip alternately on the outside of one upright and on the inside of the next. When the basket has been completely circled, the remaining end of the strip is placed on the inside of the same upright as the other end. The strip is then pressed towards the bottom of the basket. Because of the decrease in size, it will be necessary to pull on the ends of the strip as it is moved downwards. The ends are cut where they overlap on the inside of the upright, forming a continuous strip.

The following strips are placed on alternate sides of the uprights with their joints on the inner side. When the weaving is complete, the upper ring is glued in place. The top is woven in a similar manner. One end of each of the crosspieces is fastened with small nails or staples, and the weaving strips are slipped over the other end. It is best to leave off the outer crosspieces till the weaving is complete. They are slipped in place, and all of the strips are securely fastened. The surplus ends of the weaving strips are removed with shears.

The type of finish is left to the worker. The basket shown is made completely from white pine, but the rings, bottom, and uprights are stained. Two coats of shellac produce a pleasing finish.

How to Plane Woods with Twisted Grain

UNLESS a special low-angle cabinetmaker's block plane is available, it is often difficult to plane hardwoods which have a highly figured, twisted grain. To use an ordinary smooth plane, sharpen the cutter carefully, making the angle a little less than usual. Then grind the edge of the cap iron, or shaving splitter as it is sometimes called, until it is about 1/32 in. thick. Place this edge very close to the cutting edge of the cutter, and assemble the two parts by tightening the screw hard. Use plenty of pressure in clamping the cutter, and adjust for a shallow cut.

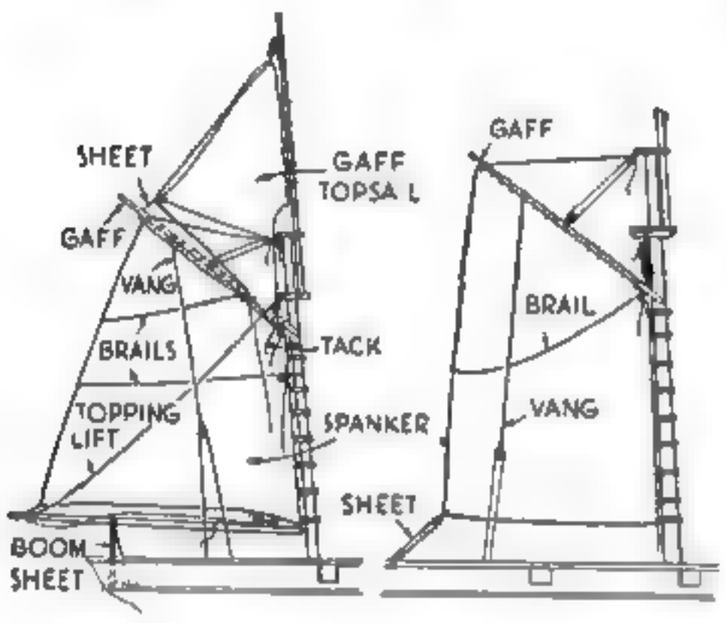
Use an even pressure in planing, because planes fitted in this way have a tendency to chatter. You will be surprised at the almost polished surface the plane will produce.—GEORGE MAGEE.

Sails for the 'Alabama' Model

(Continued from page 69)

sheets are fastened to the clews and drawn down tight to the sheet bitts. The leech lines are hitched to the leeches, and the buntlines to the foot; these lines are then rove through the blocks on the yard and through others tied to the eyes of the rigging abaft the masts, and to the deck through the lubber hole. These should hang slack on the fore side of the sails.

The halyards are small chain for the length of the topmast, then cord, finishing with a two double-block tackle to port at the fore and to starboard at the main. The lifts are as shown in the



A simplified diagram to make clear the rigging of spanker, gaff topsail, and trysails

rigging plan, but hanging down abaft the yards.

Topgallant sails are similarly fixed. The sheets are cord leading down to the fife rail. The halyards are also cord, with a double and single-block tackles on the side opposite to the topsail halyards.

Royals are the same with two single-block halyard tackles, reversing sides again.

Braces were clearly shown on the rigging plan. Although they appear as if only on one side; the other side is, of course, the same. The fore lower and topsail braces go through blocks hooked to bolts in the mainmast cheeks. Fore topgallant and royal braces reeve through double blocks seized to the stay and through others hung from the crosstrees, abaft. Main and topsail braces go to the bumpkins and finally to blocks hooked to bolts in the covering board about ¾ in. abaft the bumpkins.

One may have the yards set straight across or at any angle. I have mine at half a right angle, as if the wind (if any) were on the quarter. This looks well and allows the rigging detail to be seen. When you have the yards at the desired angle, adjust the lower ones horizontally with the topping lifts, and the others with the sail sheets.

Stunsails are made to the patterns shown, just like the other square sails. A stunsail boom is half the length of its respective yard and one third the thickness. Two thirds of the boom extends beyond the iron, and the inner end is lashed to the yard. The stunsail yard is half the length of its boom. The halyard hitches to it one third from the inner end, goes through a block tied to the boom irons or eyes and continues up to the masthead and down to the deck or the top. The tack goes through a block at the boom end and then aft to act as a brace. The double sheet ties to the yard abaft the standing sail to the windward side. On the other side, to the leeward, however, the sheet ties to the yard before the standing sail. I belayed the fore stunsail braces to the main fife rail, and the main to the poop handrail.

The *Alabama* carried five boats. I have placed a cutter and a launch amidships, open to show the thwarts and oars, and two lifeboats with their covers on abaft. There is an open gig over the stern. These boats should be black outside and white inside. They hang with two double-block tackles. As our ship appears as if under way, I swung them inboard.

Two anchors are needed. These should be not less than 1½ or more than 2 in. long. The original anchors probably were of the iron-stock pattern. On my model the chain cables are unbent, but they may be shown if desired.

According to Captain Semmes, the *Alabama* flew the long pennant at the main, the red cross of St. George at the fore, and the white ensign with blue, starry cross at the peak.

Almost any kind of base or cradle may be used, but as the model has sails set, the so-called "graving-dock" type would not be appropriate.

That would appear to be all, and I think you will agree that you have by now a very good-looking and interesting model ship.

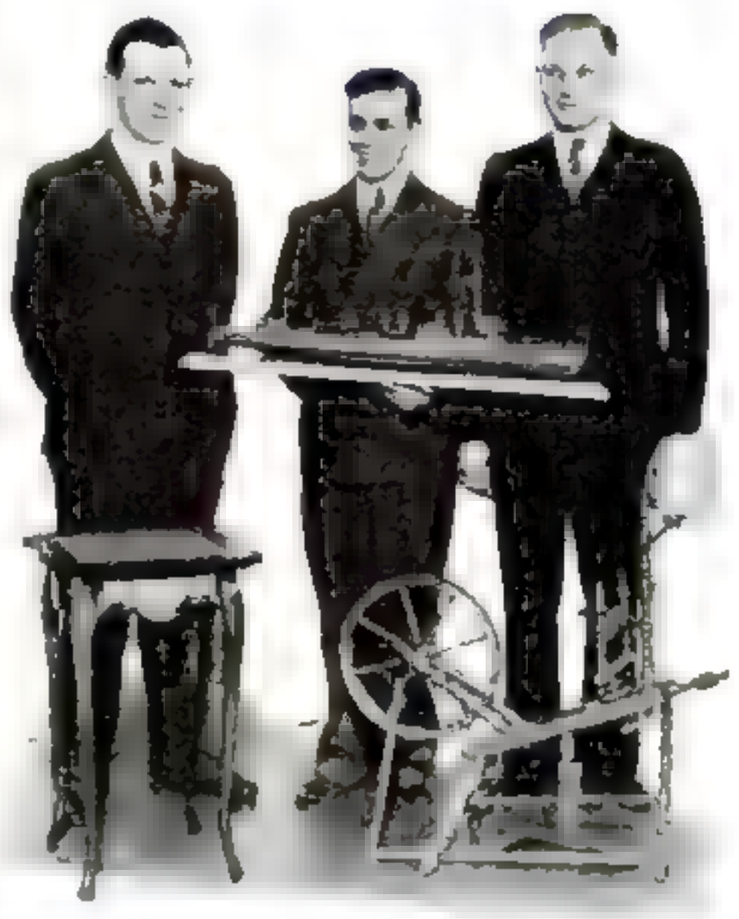
This concludes not only the Alabama *article, but the entire great series of model articles prepared for* POPULAR SCIENCE MONTHLY *by Captain McCann (see P.S.M., Feb. '38, p. 78). The lines above were written by him only a few days before his death. They were the last to come from his pen.*

Molding Sand Improved by Adding Paste

BY ADDING wall-paper paste to molding sand, I have found it possible to get sharper and better-detailed castings of small, intricate parts. About two heaping tablespoons of the dry paste are mixed thoroughly with one pint of fine, dry sand. This is sprinkled with water and mixed until the sand is wet enough to mold. If it holds together without leaving the hand wet, it is just right. Let the mold dry before pouring the metal; it will become quite hard and hold its shape much better than plain sand. Any that is left over will harden, but it can be used again by adding a little water.—EARLE S. COLLINS.

The Guild Offers You a Hearty Welcome

(Continued from page 83)



First three prize winners in the annual contest of the Edison Club, Chicago, Ill.

the Cartier Homeworkshop Club, is also interested in the hobby of photography, and a complete darkroom was recently built. Georges Frenette, club photographer, is in charge . . . Edward Gosselin spoke on developing, printing, and enlarging at a meeting of the ***Ware (Mass.)*** Homeworkshop Club . . . The Bison Homeworkshop Guild, ***Buffalo, N.Y.***, held a display of articles made in the monthly project contests. Hobby clubs from surrounding towns were invited to attend. H. DeVere Shaw won the most recent contest with a turned black-walnut, rose-petal jar.

"Ever since the club took up metal working, there has been a sharp increase in attendance and eight persons have applied for membership," the Hardwood Homeworkshop Club, ***Neenah, Wisc.***, reported to the Guild. Paul F. Steinway spoke on "Turning Your Hobby into Profit."

New officers of the ***Cudahy (Wisc.)*** Homeworkshop Club are Ray Lambert, president; June Stevens, vice president; Thurlow Hagenson, secretary, and Ray Janikowski, treasurer.

Winners in the first annual contest of the Fort Stanwix Hobby Club, ***Rome, N.Y.***, were as follows: first, Sam Wardwell; second, Albert Zingerline; third, E. W. Scothon; fourth, George Hettrick. Prizes were donated by local hardware dealers. Earnest Ankin, one of the judges, demonstrated how to make split-bamboo fishing poles. The club recently visited the Rome Continuation School to see an exhibit and demonstration by the students. A picnic will be held at a members' summer camp at Lake Delta.

More than 900 persons attended the fourth annual exhibition of the ***Wood-Ridge (N.J.)*** Homeworkshop Club. There were sixty articles on display, the most outstanding being a three-piece bedroom set. Prizes donated by local hardware and lumber concerns were awarded on the basis of a popular vote as follows: first, Henry Buntsechub; second, W. Hagemann; third, George N. Schalk; fourth, Phil Reif; fifth, H. Fritts. The members cast votes also and awarded a wooden plaque with an engraved bronze plate to G. N. Schalk. The plaque becomes the permanent possession of any member who wins it three times.

One section of the Seattle, Wash., club's hobby show. About 1,200 persons attended

Edwin Petersen demonstrated how to make and sharpen knives at a meeting of the Civic Homeworkshop Guild, ***Fort Wayne, Ind.***, in the workshop of Ernest Bower . . . A complete line of power machines has been installed in the new workshop of the Bison Builders Club, ***Buffalo, N.Y.*** John Werdein spoke on the use and care of varnish.

Members of the Fairmont (W. Va.) Homecraft Club in Charles Schinke's workshop

Send for Free Bulletin on How to Start a Club

YOUR craftsmanship will improve if you belong to a home workshop club. If there is no Guild unit in your neighborhood, why not organize a club yourself? Complete information will be sent free upon request. Write to the National Homeworkshop Guild, 347 Fourth Avenue, New York, and inclose a large, self-addressed, stamped envelope.

Twenty-One-Mile Parachute Leap

(Continued from page 43)

and float back to earth under umbrellas of silk. A few weeks before his fourteenth birthday, he got permission from one of the balloonists to go up and parachute back.

That first leap was the beginning of a lifetime of thrilling activity. It wasn't long until young Dunkel was building his own hot-air balloons and parachutes. His mother helped him cut out and sew his first outfit. Although Dunkel began using parachutes about 1913, he never bought one ready-made until 1926.

THOSE early parachutes used with the hot-air balloons were of the attached type. They opened at the instant the balloonist abandoned his craft. After Dunkel graduated from balloons to airplanes, he still used the attached 'chute.

Along about 1919, Dunkel got the idea that he could jump from a plane, fall through space for a while, then open his parachute. So he went to work and constructed a crude pack. He tied the folded 'chute with grocery string, went aloft, and jumped out. He broke the string with his hands, and pushed the parachute out until the wind caught it, and it opened. He made about twenty such jumps, until one day the silken folds refused to open as they should. By frantic effort and considerable luck, he got the 'chute open just before he reached the ground. Thereupon he abandoned the grocery-string pack, and waited for something more reliable to come along.

At that time, various parachute makers, jumpers, and inventors were experimenting with free types of packs, which could be released at any time after jumping. Dunkel remembers the device originated by a Japanese, which was a modified jack-in-the-box. The parachute was literally shot out of a wooden container by powerful steel springs. Another man had an arrangement of steel wires and canvas that could be set, somewhat like a trap, to shoot the parachute into the air. This worked all right until the jumper's body got in the way of the catapulted 'chute. Finally, Floyd Smith and Leslie Irving, working for the Government, developed a successful pack-type parachute. At first this was produced only for military use, and it was not until 1926 that Dunkel could get one.

FOR a number of years, Dunkel worked with designers and manufacturers in an effort to perfect parachutes. He was, and still is, a parachute salesman. During his most active period, he made as many as ten leaps in an afternoon, to show prospective purchasers how his wares worked. In St. Louis, he demonstrated the quick-opening features of a certain parachute by leaping from a plane only 250 feet above the ground. As the ship was in a power dive at the time, he left it at a speed of more than 200 miles an hour, sufficient to snap the parachute open instantly. Such a stunt would have been foolhardy with one of his early balloon-type models, Dunkel says. These were made of pure Japanese silk, and were inclined to split easily.

During all of his twenty-eight years of plunging through space, Dunkel has never been seriously injured. He has lost a few square inches of skin, but he has never broken a bone. He is proud of that record. But he is even more proud of the fact that, as a parachute instructor, he has dropped more than 1,000 novices into space without a single fatality.

DURING the 1932 National Air Races at Cleveland, Dunkel and a pilot took Marie McMillen to a height of 24,800 feet and Dunkel helped her get out of the plane, to drop to earth and establish a world's altitude record for women jumpers. He helped Miss McMillen train for this and other spectacular leaps.

His job as Chief of Parachute Participation at the National Air Races makes it necessary for him to supervise preparations for as many as sixty jumps a day. All the equipment used by the various jumpers must go through his hands and receive his approval before it can be used.

For many years, Dunkel has been collecting parachutes as a hobby. Stored away in his Cleveland home, he has fifty-six different kinds, representing virtually every type that has been used in America. Study of these parachutes, plus his years of jumping from the sky, has provided the groundwork for Dunkel's sensational proposal for a plunge from the stratosphere.

POPULAR SCIENCE Question Bee

TO SEE how you fared in the Question Bee on page 50, compare your answers with the correct list below. For every one that you got right, give yourself four points. A total score of 80 to 88 is good; 92 to 100 is excellent.

QUESTIONS

1. d	6. b	11. b	16. b	21. d
2. b	7. b	12. c	17. b	22. d
3. d	8. c	13. c	18. a	23. a
4. b	9. d	14. d	19. b	24. c
5. c	10. b	15. b	20. c	25. b

PICTURES

1. dead center
2. cone pulley
3. faceplate
4. tool rest
5. live center
6. headstock
7. bed
8. tail spindle
9. tailstock
10. spindle clamp

Photographs Under the Microscope

(Continued from page 75)

surface of a camera lens to determine its cleanliness, or the extent of scratches or other damage. If you cannot place the lens on the microscope stage, try holding it directly beneath the stage and focusing the microscope on it through the stage hole. Incidentally, this is also a good way to examine a microscope objective lens.

EVERY photograph reproduced in a magazine or newspaper is the result of a complicated series of photographic steps whereby the image is broken up into a series of dots of varying sizes which collect ink from the printing-press rollers and transfer it to the paper. By examining the half-tone reproductions in this magazine with your microscope, you can see these tiny dots, and observe how they vary in different parts of the pictures. Engravers who make half-tone plates for reproducing pictures, often employ a compound microscope to examine the condition of the dots and the progress of etching a zinc or other metallic plate with acid, and to make delicate corrections with sharp instruments, by altering the shapes of the dots.

Another possible use of the microscope in the amateur darkroom is as an aid in the retouching of miniature negatives. Usually, 1 by 1½-in. negatives, or those of similar small size, are never retouched to correct such faults as pinholes—tiny clear spots resulting from dust on the film. However, with the lower powers of a compound microscope, sufficiently fine tools, and a steady hand, it is possible to perform certain alterations on a small negative. In watching the movement of the brush or other instrument through a compound microscope, remember that the image is reversed, so that you have to move your hand to the right to make the brush move apparently to the left.

MANY of the chemicals used in photography, such as pyrogallic acid and hydroquinone, produce crystals that make interesting objects for study. To prepare a specimen, dissolve some of the chemical in water, place a few drops in the center of a clean glass slide, and let it stand until the water has evaporated.

By removing the regular lens from a photographic enlarger and substituting a compound microscope, mistituting a compound microscope, microphotographs, which are extremely small photographs, can be made. Positive motion-picture film or lantern-slide plates are best for this, because of their fine grain. Suppose you are going to employ a 3¼ by 4-in. lantern-slide plate. With a glass cutter, reduce it to strips from ½ to ¾ in. wide. Use one of these as a focusing screen by placing it, coated side up, on the microscope stage. Place a negative in the enlarger in the usual manner, and focus the microscope until a clear but greatly reduced image of it is formed on the strip of lantern-slide plate. A magnifying glass is useful for telling when the image is sharpest.

Now turn out the enlarger lamp, and replace the lantern-slide strip with a fresh, unexposed strip. Starting at one end, make a series of exposures, giving each a different time. Develop, fix, and wash the strip in the usual manner. After it is dry, examine the images with your microscope, and select the best for permanent preservation. If the negative was placed in the enlarger in the proper position, the tiny microphotograph on the lantern-slide plate will be right-side-to when placed with the emulsion side down and examined through the microscope. With a glass cutter, separate the best pictures from the others, place a little balsam on the emulsion side, and mount them in the centers of standard 1 by 1½-in. slides.

YOU'LL always draw a laugh if you include one of these tiny photographs when you are showing your slide collection to a friend, particularly if the picture happens to be a likeness of the friend. Usually, observation of such pictures through the microscope should be made at the same power or a power lower than that used in projecting the image with the enlarger. Usually, also, the picture will show quite a bit of grain, in spite of the relative fineness of grain in lantern-slide plates or positive film. When observed at low or moderate powers, however, the grain will not be objectionable. This stunt, incidentally, should clear up a common bit of fog in connection with microscopy. Many people do not know the difference between a photomicrograph and a microphotograph. When you take a highly enlarged picture of a tiny object through a microscope, you are making a photomicrograph. When you reduce a photographic image, in the manner described, to produce a tiny positive print, you are making a microphotograph. When the microscope works in reverse, the words have to be reversed, too!

Novel Electric Motor Has Two Rotors

ELECTRIC motors of radical new type have been produced in Germany to drive an experimental locomotive. Between the rotating armature and the stationary field it has an additional rotor—a thin set of windings shaped like a hollow cylinder, turning concentrically with the armature but on independent bearings. The scheme is declared to solve the problem of operating electric locomotives on alternating current of the "single-phase" type, with only one overhead power wire.

This One

H2NH-RFC-CFPC

Gus Gives Tips on Outboard Motors

(Continued from page 54)

and Harry a chance to laugh—and they took it.

"My guess, Professor," Gus remarked as he lifted the engine up on his bench, "is that your trouble was caused by pre-ignition. Let's see, now." He disconnected the spark-plug wires, took out a plug, glanced at it, and held it up for Clapp's inspection. What little of the porcelain insulator hadn't been burned away was covered deeply with gummy black carbon.

"THERE'S the cause of your troubles," he explained. "With burned-up plugs like this, your motor may start a little hard, but once you get it going it will run well enough until the plugs get hot. Then pre-ignition will start, and your engine will slow down, and vibrate, and act as if it were starving for gas. But when the engine slows down, the spark plugs cool off, and then the engine runs normally again—until the plugs' temperature goes back up. After a while, when the plugs and the engine are real good and hot, cutting the ignition off doesn't have any effect—she goes right on firing. That's what happened to you. I'll put in new plugs, and we'll try her out. Fill a barrel with water, will you, Harry?"

Harry filled the barrel, and Gus clamped the motor to a block in the vise so that its propeller was in the water. Then he mixed some gasoline and oil, poured it into the fuel tank, and pulled the starting cord. The engine took off easily enough, and the water in the barrel started to churn. Gus, with his head cocked to one side, listened for perhaps a minute, and then shut it off.

"That's a good engine, Professor," he said, "but it's had darned bad treatment. Better leave it here for a day or two, and let me go over it for you."

"Nonsense!" snapped Professor Clapp. "So long as it runs—"

"That will be fine, Mr. Wilson," Beverly interrupted sweetly. "I'll stop for it tomorrow, and take it out to the lake with me. Oh, I forgot to tell you, Dad, I'm staying with Aunt Molly tonight. Seems like a year since I saw a really good movie. Mother's alone, so I asked Mr. Jones to take you out with him—that must be he honking the horn outside now. I'll drive out tomorrow afternoon."

CONSIDERABLY to Gus Wilson's surprise, Harry had the shop open when he drove up at a quarter to eight the next morning, and the outboard was out on the workbench.

"Hey, what's the meaning of all this industry?" Gus demanded.

"Bev's coming in to see you about that outboard early this morning," Harry explained. "I thought you'd like to give it the once-over before you talked to her about it."

"'Bev,' hey!" Gus said. "You're getting sort of familiar with the customers' daughters, aren't you?"

"Shucks, I've known her all my life!" Harry told him. "Say, Gus, do you know why she talked her father into buying this outboard? Because she's going in the girls' race up there at the lake Saturday—that six-mile race they have every year."

"Well, she won't get anything out of it," Gus said. "Not in the professor's old rowboat. She'll be up against a lot of those little doodlebug hydroplanes that can do twenty-five easy."

HARRY grinned. "She's got a hydroplane—only her father doesn't know it yet," he explained. "That old one of Bill Hazzard's—the one he ripped the bottom out of in the marathon last year. He gave it to her, and she's had it fixed up so it's as likely as not to hold together for six miles. So now it's up to us to fix up this engine. She's not going in that race to lose."

"And that's the honest truth," said Beverly, from the doorway. "How about it, Mr. Wilson—you're with me, aren't you?"

"Well," Gus said, "I'll see what I can do."

With Harry helping, and the girl keeping up a rapid fire of not-so-dumb questions, Gus took out the fuel line and blew it clear. Then, picking up the gasoline strainer, he showed Beverly the dirt caked in the mesh. "This thing's put in to keep the dirt out of the carburetor," he said, "but hardly anybody ever thinks of cleaning it off occasionally.

"Here now, watch how I take this flywheel off. You can't pry it." Removing the nut, he struck the shaft end on top with a hammer. The flywheel came off easily, exposing the magneto.

"In the magneto, trouble usually comes from the contact points," the veteran mechanic went on. "Clean them off with 00 sandpaper, like this, and if they're worn or pitted put in new ones. And be sure to check up on the width of the gap from time to time."

BEVERLY put in a question. "Is vibration, like Father noticed, always caused by—what do you call it?—pre-ignition?"

"Oh, no," Gus replied. "It could have been a loose bearing on the steering pivot, a bent propeller, loose mounting on the boat, or poor compression in one cylinder."

By this time, Harry had the carburetor taken apart. "This is just a simplified version of the carburetor on your car," Gus pointed out. "It needs an occasional cleaning of this needle valve that regulates the gas flow. And use your head when you prime it. The only time you need to do this is when the motor is cold. More outboards are kept from starting by priming them when they're hot than by almost any

(Continued on page 102)

Gus Gives Some Tips on Outboard Motors

(Continued from page 101)

other cause. Then there's overheating—"

"And what makes an outboard overheat?" Beverly wanted to know.

"Same as in a car—running out of oil or water."

Harry chuckled. "Imagine a boat running out of water!"

By way of reply, Gus dug into the motor's cooling system. "Easiest thing you know," he said. "If the water pump isn't clean, and the feed pipe and connections aren't tight, it's a case of 'water, water everywhere' and not a drop for the cylinder jacket where it's needed. Just look at the dirt and hunks of string in this feed pipe!"

WITH deft, sure motions, he removed the cylinders to inspect the pistons and rings. "You're lucky," he commented. "The rings seat well, and the cylinder walls gleam all over, showing that they're not scored. Now let's take a peek at the gear box." Removing the cover, he washed out the box with kerosene and inspected the gears closely. "Everything's O.K. here," he reported. "No pitting, no chipping."

Packing the gear box with grease and oiling the cylinder walls and bearings, Gus reassembled the motor. He signaled Harry to put the motor back in the barrel, put in fuel, and started it.

Gus listened to the motor for a couple of minutes, and then nodded his satisfaction. "She'll do," he said. "Maybe she'll kick that patched up hull along too fast for it to hold together. Know how to swim, Bev?"

"Of course," said Beverly, "but this is a boat race. Oh, and Mr. Wilson, I'll need Harry to help me get the motor adjusted on the boat. Saturday morning—early—would do."

"That's a busy day around here, Bev. Well, all right. But he's got to be back Saturday evening—sure!"

IT WAS a little after four o'clock Saturday afternoon when the telephone rang. Gus went into the office and took up the receiver.

"That you, Mr. Wilson?" said the voice at the other end of the wire. "Well, I won! The old boat just held together long enough. You certainly put-put that outboard right! Next time you come up this way, I'm going to mix you something nice in the silver bowl they gave me."

"That's fine!" Gus said. "I'm glad you won—mighty glad, Bev! And now do me a favor, and start Harry home."

"Oh, Harry," Beverly said. "It would be a shame to make him start home now, Mr. Wilson. He's got that power lawn mower we bought three years ago *going!* No one ever has been able to start it, so now Dad thinks he's just grand. Couldn't you get along without him until Monday morning, *please?*"

"What's the use?" asked Gus, and hung up.

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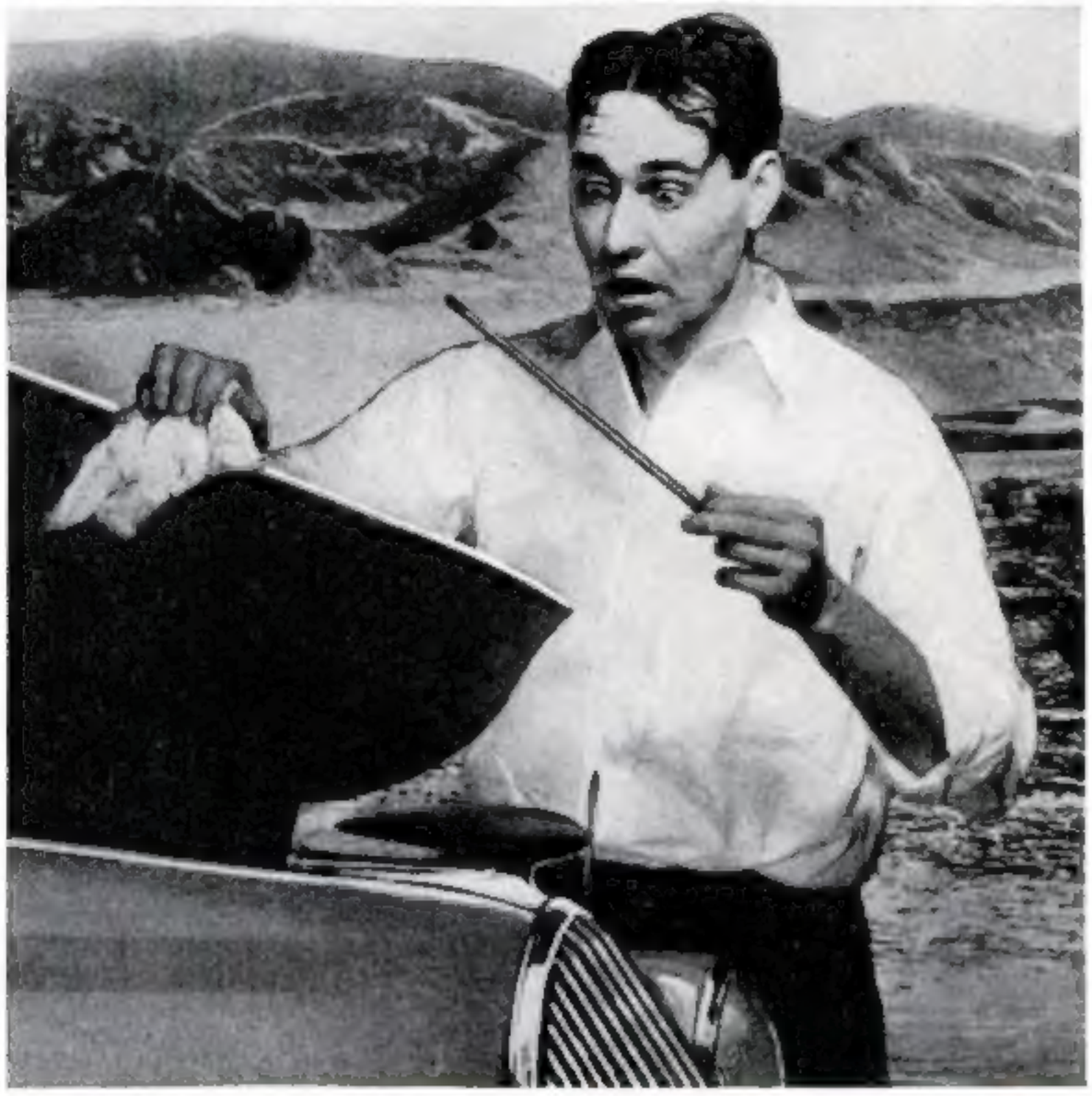

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